SPECIAL BONUS: ROM NEWS INSIDE | TERRIBLE DINOCARIDS

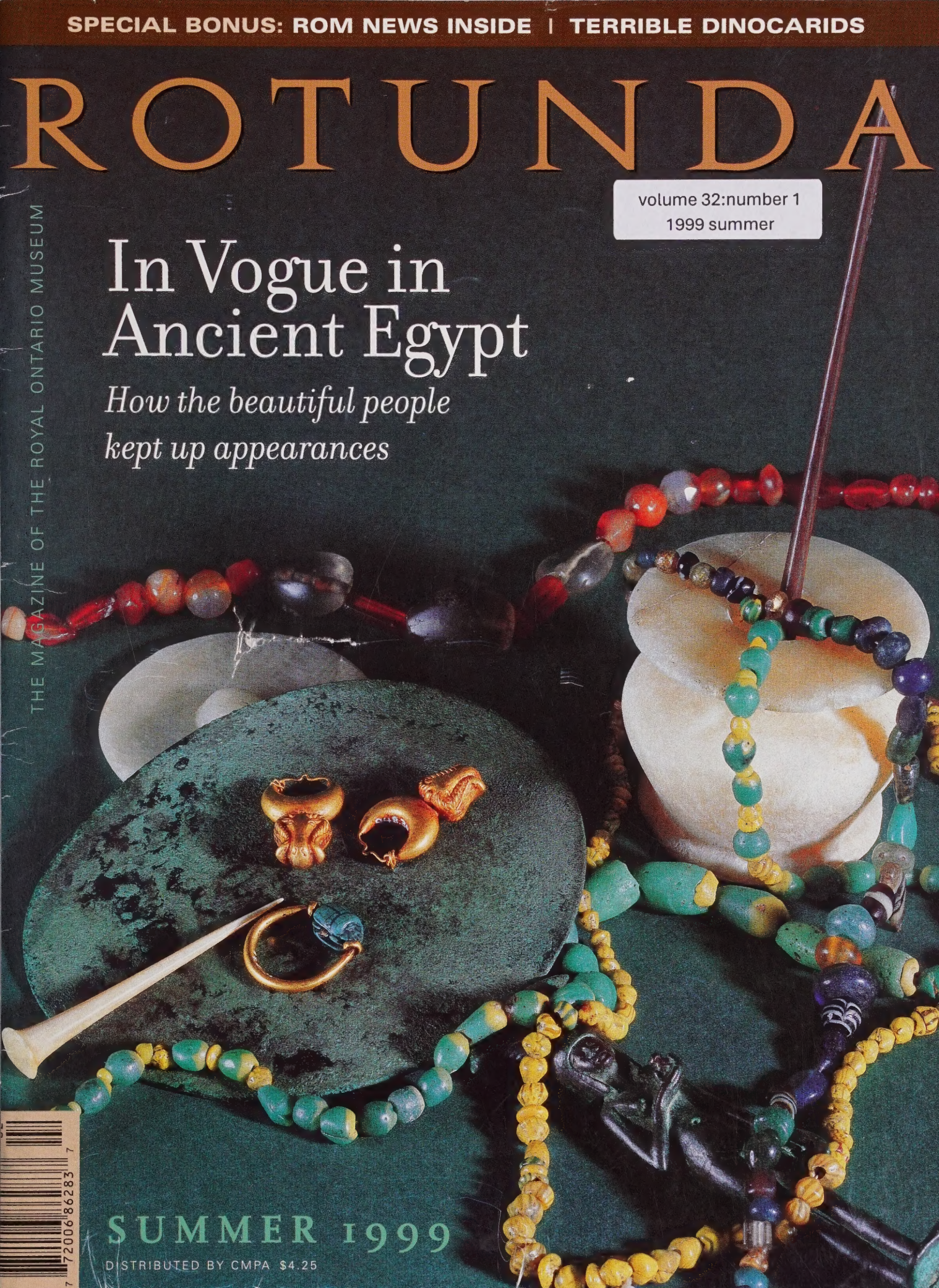
ROTUNDA

volume 32:number 1
1999 summer

THE MAGAZINE OF THE ROYAL ONTARIO MUSEUM

In Vogue in Ancient Egypt

How the beautiful people kept up appearances



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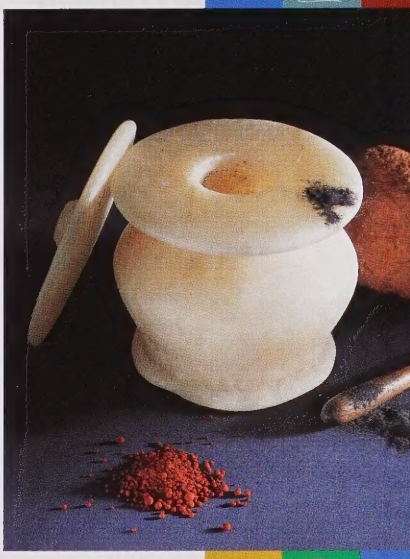

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EXECUTIVE EDITOR
Sandra Piller
MANAGING EDITOR / BOOK REVIEWS
Glen Ellis
EDITOR
Lee-Anne Jack
DESIGN AND PRODUCTION
Peter Enneson Design Inc.
PHOTOGRAPHY
Brian Boyle
CONTRIBUTING EDITORS
Peter Kaellgren, Susan Stock, Cathy Ayley, Mark Engstrom, Mary Burridge, Ian McGregor, Julia Matthews
ADMINISTRATIVE ASSISTANT
Jennifer Little

ADVERTISING SALES
Sandra Piller, Executive Editor
(416) 586-5758

EDITORIAL AND MARKETING OFFICES
Rotunda, the magazine of the Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6, or telephone (416) 586-5585, fax (416) 586-5887
e-mail lee-anne@rom.on.ca
ROM Web site: www.rom.on.ca

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THE ROM GRATEFULLY ACKNOWLEDGES THE LOUISE HAWLEY STONE CHARITABLE TRUST FOR ITS GENEROUS SUPPORT OF THIS PUBLICATION

LEE-ANNE JACK

LEARNING WHAT palaeontologists can decipher from a single bone or marvelling at such exotica as vomit spatulas used by the lost Taino civilization of Cuba (more on this in the next issue) are part of what makes working at the ROM so exhilarating. In this first issue of the new *Rotunda*, you'll notice a few changes, beginning with "Explorations" (page 6), a column devoted to intriguing behind-the-scenes stories; celestial wayfinding becomes easy as the magazine welcomes astronomy educator Ian McGregor ("Stargazing," page 11); using the urban backyard as microcosm, members of the ROM's Centre for Biodiversity and Conservation Biology examine ecology ("Backyard Biodiversity," page 13); and librarian Julia Matthews, keeper of the ROM's photographic archives, reminds us of the Museum's own rich history ("From the Archives," page 52).

Perhaps the most striking difference is *Rotunda*'s new look, skilfully fashioned by art director Peter Enneson. We think that Peter's fresh new design will enable *Rotunda* to communicate, even more effectively, the Museum's collections, galleries, and research.

In the world of "haute couture," the ancient Egyptians were among the most dazzling in their sense of style. For researchers today, a particular coiffure or costume captured in Egyptian sculpture or painting can be an excellent indicator of the time period in which it was created. In our cover story, Egyptologist Roberta Shaw brings you the latest on what was in vogue throughout Pharonic times.

On a more cosmic scale, change and adaptation have led to the trial-and-error evolution of life itself and to the environment of Earth as we know it today. Janet Waddington, assistant curator of Palaeontology, details the history of our third rock from the sun. The charming illustrations that accompany this article were selected from a series by Blair Drawson, which can be seen in its entirety in the newly opened Dynamic Earth: Inco Limited Gallery of Earth Sciences.

Captured in stone as part of the fossil record of British Columbia's Burgess Shale, the Cambrian predator *Anomalocaris canadensis* so confounded scientists that it was, at various times, thought to be a sea cucumber, a jelly fish, and a shrimp. Only in recent years has it finally been identified as one of a group of previously unknown arthropods—the "dinocarids." ROM palaeontologist Des Collins, who has collected and studied Burgess Shale fossils for 17 years, recounts the numerous red herrings and plot twists by which this prehistoric marauder defied identification.

In 1977, the ROM opened one of the first discovery rooms in North America. Betty Stein, manager of the Museum's new Discovery Gallery, writes about theories of how children learn, and how they led to the dynamic, interactive gallery of today.

BRIAN BOYLE, ROM

I hope you find the new *Rotunda* to be enjoyable summer reading.

LINDSAY SHARP

THERE IS NOTHING LIKE a powerful narrative to fire the imagination and impart a fuller sense of a subject in all its complexity. In recent times at the ROM, we have begun to describe our mandate as being, first and foremost, about developing narratives that bring to life our research and collections for our public.

The possibilities for this are endless. The Museum has more than five million objects in its collections, each with its own links to the grand story of evolution in human cultures or the natural world. From the smallest fossil that marks the period when life began to flourish on Earth to advertising in the 20th century, our collections span almost every subject under the sun.

This great breadth of material is a source of challenge as well as a great strength. The ROM has limits to its physical resources and space and cannot be comprehensive in its displays. For this reason, we have begun the daunting task of identifying the most promising sources for future narrative development. We have also broadened our view on the methods we will use to communicate these narratives: publications, video, narrowcast and broadcast, the Web, and public programs will be considered alongside major galleries and exhibitions.

Lindsay Sharp with Canadian wolverine specimen.

Over the past winter, teams of curatorial staff have documented our vast collections and research programs, and classified them under the ROM's four principal themes: *Life on Earth; Culture, Art and Design; Earth and Cosmos;* and *Peoples of Canada.* We are now in the midst of narrowing the possibilities into a short list of our priorities. These storylines may change over time in response to new discoveries, advances in knowledge, or changes in public interest.

This process has challenged us to look at our subject material in totally new ways. But one fact remains clear: our tales are extraordinarily rich when we can integrate many different perspectives. This is a unique advantage of the ROM. The story of *Canadian Forests*, for example, can be drawn from anthropology, biodiversity, art history, and social history to explain how Canadian forests are intertwined with the growth and development of Canada.

One concept in early draft tells the story of Dr. Bob Murphy who is among only a handful of scientists working tirelessly to document the incredible biodiversity of tropical rainforests before it is lost forever. Another tells the story of the wolverine—that ultimate Canadian predator with a lethal combination of aggression and tooth-and-claw efficiency.

Many more will emerge before our review is over. Although I cannot provide a list of finals yet, I promise that the ROM's stories will be powerful and will engage you in ways that you never before imagined—the aim of all great storytellers throughout history.

GENERAL INFORMATION
ROYAL ONTARIO MUSEUM

The public is invited to join the Royal Ontario Museum and to share in its activities. Members automatically receive *Rotunda*. For further information write Membership Services, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6, or telephone (416) 586-5700.

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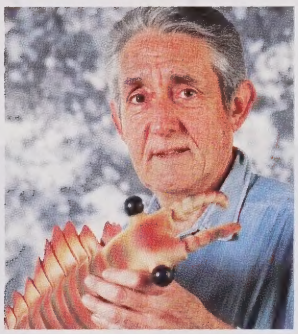
Betty Stein

Manager, Discovery Gallery

BETTY STEIN ("Bending the Learning Curve"), manager of the Museum's Discovery Gallery, was instrumental in its development. With degrees in both the arts and sciences and a Master's degree in Museum Studies, Betty has worked in a variety of capacities in museums and heritage organizations in Toronto, and particularly enjoys leaning about how visitors experience museums.



Desmond Collins

Department of Palaeobiology

DESMOND COLLINS ("Dinocarids: The First Monster Predators on Earth") is senior curator in the ROM's Department of Palaeobiology. Since 1975, he has spearheaded a major excavation and collecting effort to recover 505-million-year-old fossil fauna from British Columbia's Burgess Shale. Des has uncovered four new animal communities among these fossils. The National Geographic Society has supported this fieldwork for nine seasons.

Roberta Shaw

Department of Near Eastern and Asian Civilizations

ROBERTA LAWRIE SHAW ("They Walked in Beauty"), assistant curator in the Department of Near Eastern and Asian Civilizations, has conducted fieldwork and developed galleries in Egypt. Recently, Roberta was guest curator at the Canadian Museum of Civilization for the show *Mysteries of Egypt* held in conjunction with the opening of an Imax film of the same title.

Janet Waddington

Department of Palaeobiology

JANET WADDINGTON ("Earth: The Alien Planet"), an assistant curator in the Palaeobiology Department, was heavily involved in the planning of Dynamic Earth: Inco Limited Gallery of Earth Sciences. She also oversees the care of the ROM's invertebrate fossil collection. Currently, Janet is studying rare fossil scorpions from Ontario, their movement from the sea onto land, and the implications of this on our understanding of the ancient environment.

ED KEALL, ROM

Gone with the Wind

Erosion makes dating difficult

THIS ELEVATED footprint in the desert of southwestern Yemen is a bizarre reflection of the natural phenomenon called deflation. Abrasive sand-filled winds that whip inland off the Red Sea coast cause rapid erosion, which quickly removed the soft sediments surrounding this hard-baked footprint. For ROM archaeologists investigating a Bronze-Age megalithic culture in the region, the process is to blame for some of their worst dating dilemmas. As the wind steals away with layers of sand and soil, an artifact of ancient antiquity may be found on the same surface as an item dropped the day before. Without intact stratified deposits — which can be dated fairly accurately—it may be impossible to determine an artifact's exact age.

Ed Keall

BRIAN BOYLE, ROM

Paul Kane's Poetic View

A river may not have run through it

IN THE SUMMER of 1847, Canadian artist Paul Kane travelled along the Columbia River and at every opportunity sketched the landscape and the Native Peoples he encountered. Back in his Toronto studio, he worked his sketches up into formal oil-on-canvas paintings.

These were extremely well received by his contemporary audiences, who praised their accuracy. One reviewer of the day wrote: "It is evident, to the most careless observer, that nothing short of the most intimate acquaintance with each subject, could have produced the accuracy of detail with such striking effect of light and shade."

But Kane's contemporaries did not have our advantage of being able to compare his field sketches to his finished work. The canvas pictured above, titled *The Rock of the Nesperces Girl,* depicts a section of the Lower Columbia River. Fishing activities are represented in the foreground; the "rock" holds a central position in the background. Is this really the scene Kane viewed in the summer of 1847? If we were able to go back in time could we sit where Kane sat and look out over the same scene of water, rock, and distant mountains?

In fact, his watercolour sketch reveals that the rock formation, known as Beacon Rock, was situated on the border of a meadow in which lay an encampment. To create a fishing scene in the oil painting, Kane altered the foreground to Beacon Rock by giving it a river setting. He also added a sturgeon-nose canoe, a type common to the people of the Upper Columbia River, but not to those along the river's lower reaches, the region where Beacon Rock is located.

Although Kane drew inspiration from his field sketches in developing the scene, his final composition is not a precise rendering of geographical and historical accuracy. Kane was, in the end, a painter in keeping with the "romantic" conventions of his day: he left the field an artist-ethnographer and entered the studio a poetic inventor.

Kenneth Lister

BRIAN BOYLE, ROM

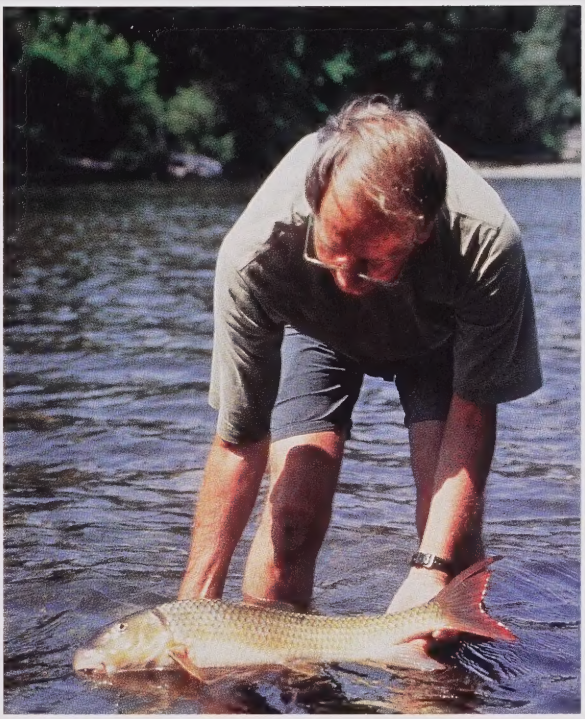
Tantor's Legacy

Elephant bones help identify Ice-age relatives

ROM SCIENTISTS Susan Woodward and Kevin Seymour recently recovered the complete skeleton of Tantor, a Toronto Zoo elephant who had died of complications following tusk surgery. Now kept in boxes in the Museum's research collections, his bones help mammalogists and palaeontologists to compare and correctly identify other bones and fossils. Much of a palaeontologist's work builds on identification for which a comparative collection is essential. Many useful characteristics, including muscle and tendon attachment sites, are not easily photographed or routinely published. "Reference books often show complete skeletons of mastodons, for example," says Seymour, "and a photo can sometimes help. But our brains are really geared towards three-dimensionality. If we want to get it right, nothing can replace comparing an unidentified bone with the real thing."

While mammalogists have the opportunity to study an animal's soft tissue such as muscle, DNA, or enzymes, and to look at the animal in its natural habitat, palaeontologists—who study extinct creatures—rely on bones alone to determine what an animal looked like, how it moved, and even what it ate.

Until 10,000 years ago, three members of the elephant order lived in North America: mastodon, gomphothere, and mammoth, a direct relative of the African elephant. Seymour has already used Tantor's bones to identify three Ice-age fossils.



GEOFF BERNARDO

The Rare Redhorse

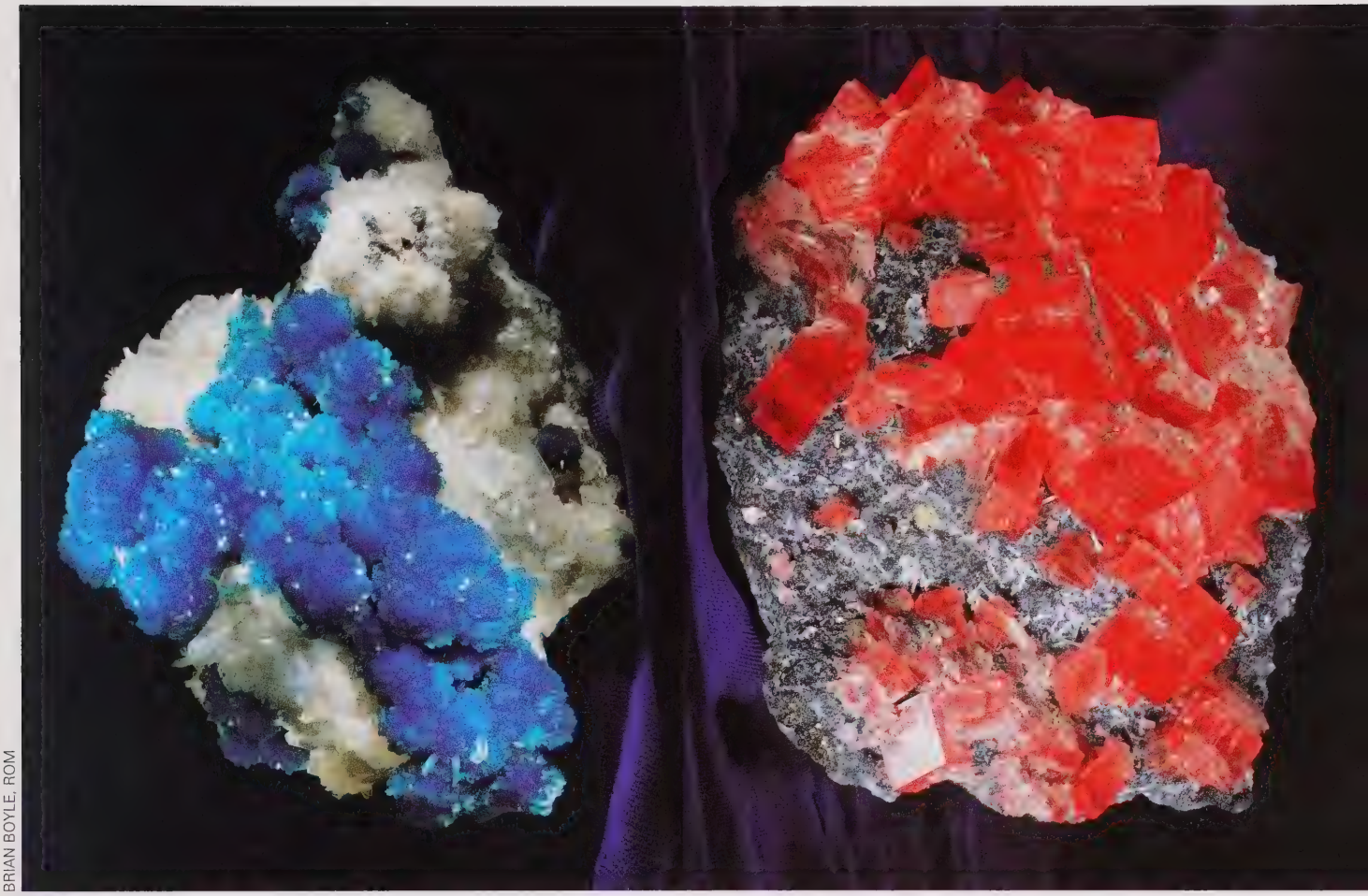
A successful search for elusive suckers

THERE MAY BE A SUCKER born every minute, but he or she is not likely to be from a group of fish species known as redhorse suckers (*Moxostoma*), which may well be at risk in Ontario waters. These creatures with thick, fleshy lips full of taste buds and a set of teeth in their throats are sensitive to the effects of agriculture and urbanization. ROM assistant curator Erling Holm, who has studied these elusive denizens of Ontario's deep, fast-flowing waters for 20 years, says they are an important link in a river's food chain. Last year, Holm and Bob Jenkins (pictured above) of Roanoke College, Virginia, the world's foremost redhorse expert, captured more than 100 redhorses of four species in the Trent River; of those, two greater redhorse and eight river redhorse specimens came to the ROM for further studies. The remains of zebra mussels were found among the gut contents of one fish, indicating that river redhorse may serve as important control agents. Because these fish live in habitats that are hard to sample and the six species are notoriously difficult even for experienced fishery biologists to tell apart, there is still much to be learned about them. But there is now hope that the redhorse are not as rare as originally feared.

EARTH AND COSMOS

Rare Beauties

The magnificence of these two recently acquired mineral specimens is crystal clear



BRIAN BOYLE, ROM

This rare cavansite specimen with its startlingly blue crystals (left) and the intensely red rhodochrosite are both on display in the Colour Activity Bay in the Dynamic Earth: Inco Limited Gallery of Earth Sciences.

EVERY NOW AND AGAIN there is a find in the mineral kingdom that redefines beauty. The striking rhodochrosite specimens from the Sweet Home Mine in Colorado, one of which was recently acquired by the ROM, fall into this category. A manganese carbonate, rhodochrosite is very soft and easily broken. Our specimen, measuring 18 x 15 x 6 cm (7 x 6 x 2½ inches), is remarkable in its many intact gemmy or translucent, cherry-red crystals of up to 3.5 cm (1¼ inches) in diameter. It sits on a bed of quartz and various sulphide minerals.

Rhodochrosite crystals are more commonly pinkish in tone, but those mined from the Sweet Home site are frequently the intense red of the ROM's specimen, and several suitable for faceting into spectacular gems for collectors and museums have been discovered there. One of these, a stunning 17.7 carat stone, is

MALCOLM BACK

on display in the ROM's S. R. Perren Gem and Gold Room.

Developed in 1873, the Sweet Home was doomed to failure as a silver mine. Although its silver veins were quite rich, they were narrow and erratic. But mineral collectors were intrigued by reports of the mine's beautiful crystal specimens. In the mid-1960s, the Sweet Home became one of only a handful of mines in the world to be worked exclusively for minerals. The climax of this under-

taking was the discovery in 1992 of the "Alma King" crystal. This huge specimen, 12.7 cm (5 inches) in diameter, is on display in the Denver Museum of Natural History. If ever you find yourself in Denver, don't miss the opportunity to see it.

Cavansite

The mineral cavansite, which has become synonymous with the Wagholi quarries in India's Maharashtra province, is extremely rare. The quarries are a source of basalt, a dark, very hard volcanic rock used for construction. Underlying this surface rock are various different volcanic layers, and it is near the contact between these disparate rock types that the luminous crystals of cavansite are found. While quarrying for basalt, miners began to find small sprays of the bright blue mineral, and in 1988 the first of a few big cavansite finds was made.

The mineral's name is derived from its chemical composition: it is a hydrated calcium, vanadium silicate. There are only two other known localities for this rare mineral, both in Oregon. But by far the finest specimens have come from India. The ROM's measures 12 x 8 x 8 cm (4¾ x 3 x 3 inches) with individual spherical crystal aggregates of up to 1.5 cm (⅝ inch) in diameter. The cavansite's blue, one of the most intense and arguably most sublime in all of the mineral kingdom, contrasts vividly with its background of white-to-colourless stilbite crystals. These combined qualities of rarity, size, and aesthetics, place this cavansite specimen among the world's finest.

The Earth Sciences collections, like those of many other departments in the Museum, have benefited over the years from the contributions of numerous individuals and companies. These new specimens are just two of many that have been acquired through the generosity of Mrs. Hertha Haist in memory of her first husband, Dr. Max Hans Frohberg. Mrs. Haist requested that the Earth Sciences Department acquire specimens on her behalf, ones that Dr. Frohberg would have been proud to own. He had assembled one of the finest mineral collections in Canada, and in 1971, when the opportunity arose, the International Nickel Company of Canada Limited provided the funds needed to acquire this important collection. Inco Limited also provided funds for the 1967 reconstruction of the ROM's Gallery of Mineralogy and has contributed generously toward the new Dynamic Earth: Inco Limited Gallery of Earth Sciences. The two outstanding new mineral samples are on display in the Treasures section of the gallery, where they have joined many other "Frohberg specimens."

Malcolm Back is the X-ray technician in the Department of Earth Sciences, Royal Ontario Museum. He uses the X-ray diffraction method to identify specimens, characterize new mineral species, and aid other departments with conservation concerns related to their artifacts.

Summer Sky Delights

An invitation to discover the universe

IAN MCGREGOR, ROM

Summer is a good time to catch the spectral beauty of light from the Milky Way Galaxy.

IAN MCGREGOR

Summer is the season to spend more time outdoors enjoying the greatest show beyond Earth—the night sky. While the number of hours of truly dark sky in June is limited, by late July earlier sunsets and longer evening observing hours allow a host of well-known objects and events to be seen by the enthusiastic observer. High overhead, a trio of bright stars named Vega, Deneb, and Altair form a giant triangle known appropriately as the "Summer Triangle" while low in the south the "teapot-shaped" constellation of Sagittarius the Archer and Scorpius the Scorpion stand side by side. In dark skies, observers can see the beautiful band of light of our Milky Way Galaxy rising from the south in Sagittarius, passing through the Summer Triangle stars overhead, and descending toward the northern horizon.

Sky Highlights: The Sun

On June 21 at 3:49 pm Eastern Daylight Time the June solstice marks the beginning of the summer season. The Sun rises on the northeast horizon in the morning, reaching its highest point for the entire year at mid-day, and setting in the northwest. Ontarians experience about 15.5 hours of daylight and only 8.5 hours of night. Three months later, the Sun reaches the fall equinox on September 23 at 7:32 am Eastern Daylight Time. On this date, the Sun rises directly in the east and sets directly in the west giving us about 12 hours of daylight and 12 hours of night.

Eclipses

A partial eclipse of the Moon takes place on July 28 in the faint constellation of Capricornus. Only those in areas west of the Great Lakes will be able to see the event. Two weeks later, on August 11, the 20th century's last total eclipse of the Sun takes place. This event is not visible from Canada and eclipse chasers must travel to Europe, Turkey, the Middle East, or India to see it. The maximum duration of total eclipse is 2 minutes, 23 seconds.

Prominent Planets

Early summer skies feature Venus as a brilliant "evening star" very low in the west. In mid-July, Venus is near the bright star Regulus in the constellation of Leo. On July 15, Venus, Regulus, and the waxing crescent Moon make an attractive grouping in the west about an hour after sunset. The planet passes between the Earth and Sun during August and reappears in the eastern sky before sunrise in late August where it will be a "morning star" for the rest of the year.

Mars appears as one of the brightest "stars" in the southern sky during the summer in the early evening. It was at its best this year in April when it was a brilliant fiery orange, but it is now fading as it moves rapidly against the background stars from the constellation of Virgo in June, through Libra, and reaching Scorpius in September. By late summer it is near the bright red star Antares (Antares means "rival of Mars") in Scorpius.

Jupiter and Saturn are fairly close to each other in the sky. In the early summer they are best seen in the east just before sunrise but by late summer they rise in the east around 10 pm. Jupiter is the westernmost and brighter of the two giant planets.

Meteor Shower

The best-known annual meteor shower, the Perseids, will peak in activity this year on the morning of August 13. The Moon will be just past New Moon phase and will not interfere with viewing. An observer living near city lights may see around 30 meteors per hour while a dark country sky will reveal up to 100 meteors per hour. Activity is good on the nights on either side of the peak also.

Ian McGregor is an astronomer in the ROM's Education Department.

A World of Difference

Variety is not only the spice but the very essence of life

The other day I heard biodiversity referred to as the "buzzword of the '90s." It's a term that has extended beyond scientific jargon to the popular vernacular, and one we often hear paired with the word "crisis." What exactly is biodiversity and how concerned should we be about the global crisis affecting it?

First coined in the 1980s when the notion of impending environmental disaster became a worldwide concern, the term "biodiversity" refers to the incredible variety of life on Earth—from slime molds to Siberian Tigers—and to the relationships among all living things. The product of millions of years of evolutionary change, biodiversity is multi-levelled, encompassing genetic, species, and ecosystem diversity. It is a delicate web of inter-relationships, tenuously linked and vulnerable to even minute changes in its composition. The milkweed plant, for example, is considered a noxious weed to Ontario farmers, but to the monarch butterfly, milkweed provides its sole food source during the larval, or caterpillar, life stage. Wipe out milkweed, and the monarch butterfly will disappear from Ontario.

Species are the fundamental units of biodiversity, each representing a separate evolutionary lineage. Scientists have described and named approximately 1.4 million species, and they estimate

CATHY AYLEY

THOM SEVALRUD / SHELLEY BROWN + ASSOCIATES

that there may be between 10 million and 30 million more that have yet to be discovered. Many of these may disappear before we have the chance to study them, and it is this crisis that in 1990 prompted the world's first Earth Summit in Rio de Janeiro, Brazil. This international meeting led to unprecedented collaboration between developed and developing nations to conserve the world's natural heritage for future generations. This global work towards a common goal illustrates the magnitude of the problem, and should serve as a wake-up call to all people that the crisis poses a serious threat to our well-being and survival.

The images most often conjured up by the word *biodiversity* are of tropical rainforests. And although they now cover only 6 per cent of the Earth's land surface, they are home to more than half of all the world's terrestrial species. Biodiversity, however, is all around us, and even our backyards are mini-ecosystems that support an astonishing variety of life. Whether your own backyard is an apartment balcony or a large natural ravine, it supports a variety of species, each of which has a special ecological niche and contributes to environmental health. Though many of these species are common, they are nevertheless important threads in the fabric of life. Only by learning about all the types of organisms around us can we understand and value them as intrinsic components of the ecosystem and work toward their conservation. Staff in the ROM's Centre for Biodiversity and Conservation Biology are continually studying biodiversity, and will be introducing to you in this column some common and not-so-common local and exotic species that you might see in your backyard—small but important filaments in the worldwide web of life.

Cathy Ayley is administrative coordinator of the ROM's Centre for Biodiversity and Conservation Biology and is currently a member of the Centre's shorebird research team.

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They Walked In

ALL PHOTOS BY BRIAN BOYLE, ROM

BEAUTY

**She casts the noose on me with her hair,
She captures me with her eye,
She tethers me with her necklace,
She brands me with her seal ring.**
(FROM A LOVE SONG, C. 1300 BC)

Artwork and artifacts of Ancient Egypt reveal the fluctuating fashions of this glamorous people

BY ROBERTA SHAW

The simple design of this ivory hair pin of unknown date was in use from earliest times.

THE TREASURES of ancient Egypt, housed in museums throughout the world, are tellingly populated by images of glittering, elegantly coiffed people, leaving little doubt that the Egyptians had a gift for glamour. This trove of archaeological material offers us glimpses into their aesthetic world and allows us to understand and admire their ideals of beauty.

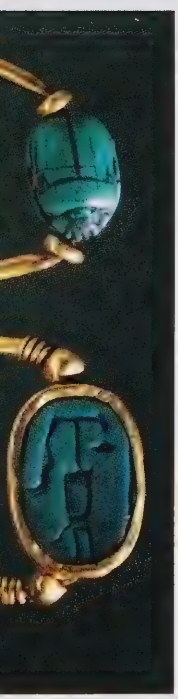
Innovators in engineering, the arts, and funerary practices, the enterprising Egyptians turned their minds as as-

siduously to perfecting the art of personal adornment. In their wish to look their best, in death and in life, these people of the Nile devoted considerable effort and expense to their appearance. The survey below outlines the trends in meticulous grooming and creative adornment adopted by Egyptian men, women, and children of all classes from the earliest dynastic kingdoms to Greco-Roman times.

HAIR

THE SPECTRE OF BAD HAIR DAYS has haunted us for millennia, but the ancient Egyptians were ingenious at devising solutions.

The elaborate, perfect coiffeurs of the men and women in Egyptian paintings and sculpture likely represent wigs, which were *de rigeur* for the wealthy, at least on social occasions. It is not known if they were worn constantly. Hair extensions, made with bunches of cornrows, have been found among ladies' tomb goods, and a recently discovered predynastic mummy, dating to around 3500 BC, has dreadlocks. (Most mummies do have hair but it is generally pressed flat against the skull by the tight wrappings of linen bandaging.) Wigs were usually fashioned from real hair or occasionally from fibre, and styles varied greatly.



Scientific studies reveal that henna (still used today) was applied from as early as c. 3400 BC to cover the greying of this predominantly black-haired people. Papyrus documents have also supplied us with potent advice to prevent balding. One recipe called for "the fats of lion, hippopotamus, crocodile, cat, serpent, and goat. Make into one," it advised, "and rub the head of the bald one therewith."

For Egyptologists, hairstyles prove useful in dating objects without provenance or inscriptions. While women of the New Kingdom (1550–1070 BC) preferred very long hair or wigs, many in the Old Kingdom (2649–2134 BC) are represented in short cuts or chin-length bobs. The "Hathor wig" denotes a date somewhere in the Middle Kingdom (2040–1640 BC), and the "bag wig" did not appear until the 26th Dynasty (c. 600 BC). The late 18th Dynasty (c. 1400 BC) ushered in an era of very elaborate "baroque" fashion that featured voluminous wigs and costume, which lasted several centuries.

Men were equally fastidious about grooming, and their coiffeurs were arranged into a variety of lengths and styles as painstakingly as those of their wives and mothers. Facial hair, too, followed specific trends. Moustaches were favoured in the Old Kingdom, while full, neatly trimmed beards with moustaches came into style in the Middle Kingdom. During the New Kingdom, men often sported short goatees. A child's hairstyle first attested to in the Old Kingdom, which continued as a hallmark of childhood for both girls and boys to the end of pharaonic history (323 AD), was the "sidelock of youth"—a shaven head save for a circle of hair on one side, which was bound or braided and decorated with jewellery. The popular bronze statuettes of the goddess Isis with her young son, Horus, often portray him in this style.

From the dawn of human adornment, the hair has attracted decoration. A delicate diadem of gold, turquoise, garnet, and malachite beads was found on an ancient Egyptian body dated to as early as 3200 BC. Another diadem, radiating hundreds of gold tubes that threaded to the tresses of a wig, was found among the jewels of a Middle Kingdom princess. Its weight must have limited the head movements of her highness.

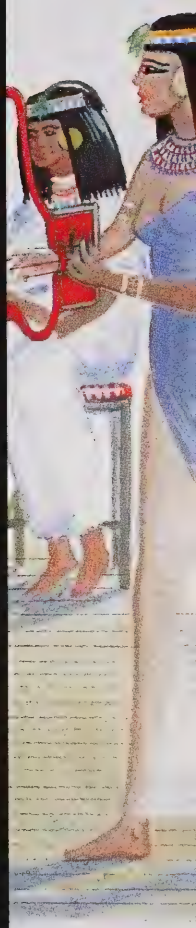
Those of lesser social rank made do with simpler and cheaper hair accessories such as fillets of petals and berries that simply tied at the back of the head. They may have been made from real flowers, petals, and leaves sewn to a papyrus backing, similar to ones found among King Tutankhamun's goods, or of stone inlay in plant forms.

JEWELLERY

ADORNED FROM HEAD TO ANKLE, ancient Egyptians loved a myriad of colour and design in their jewellery, which they wore in great quantity. While the effect might seem rather garish today, it must be remembered that their adornments were worn against either stark white linen or a brown-skinned naked body, excellent backgrounds for those miniature works of art.

Adorned from head to ankle, ancient Egyptians loved a myria

Below: The glazed composition beads in this broad collar from Amarna were restrung using an ancient model. Left: This string of gold amulets dates to the early Old Kingdom. The falcon shape suggests royal ownership. Far left: The swivel setting on these scarab rings allowed the underside to be used as a seal.



of colour and design in their jewellery, which they wore in great abundance

Left: So great a number of glazed composition rings, like these of New Kingdom date, were found at the palace of Amunhotep III that it is likely they were passed out as party favours. Right: This necklace with various amulets of gold and glazed composition dates to the New Kingdom. Below: The glitterati at a banquet in the 18th Dynasty, the "zenith" of ancient Egyptian culture. Such events offered the perfect opportunity to see and be seen.

ILLUSTRATION BY DOUGLAS CHAMPION

Ancient jewellers made use of gold, silver (then rarer and more expensive than gold), and semi-precious stones, such as turquoise, lapis lazuli, carnelian, jasper, feldspar, amethyst, and garnet, to create stunning ornaments. Their production methods were inspired, mixing artistry and technology. Their cloisonné work was outstanding. Tiny cloisonnes, or cells, were fashioned from metal strips to house inlays of stone cut to an exact fit. Granulation, the soldering of hundreds of tiny gold granules to a metal surface to form patterns, was another labour-intensive technique perfected in early Egypt. The fine metalwork shows virtually no traces of soldering.

The "cheap plastic" of the time was a substance referred to until recently as faience, now called glazed composition. This remarkable invention, devised even before the written word, enabled every member of society to own at least some trinkets. Made of ground quartz and mineral glaze, it was generally produced in the same colours as the more expensive stones and could be quickly and easily moulded and worked into beads, inlays, and amulets. Simple strings of these beads once adorned all the bodies of Egypt—even King Tutankhamun's parure is filled with this "fakery." Glass, which may have been discovered by accident during glazed composition production, is almost unknown until the New Kingdom. From the time of Amunhotep III (c. 1375 BC) it becomes an integral element in jewellery.

These materials were cunningly and magnificently crafted into jewellery, fashion accessories, and hair ornaments that still dazzle us today. Strings of beads and perhaps an amulet for luck and protection often served as necklaces, but the most distinctive neck ornamentation was the Egyptian broad collar. These impressive pieces consisted of hundreds of small elements strung together in a circular collar that covered the chest, shoulders, and back. Particularly elaborate collars required a counterpoise at the back to keep them in place. An abundance of gold and expensive inlay was used in royal collars; more plebian pieces were produced with glazed composition, a fine example of which can be seen in the ROM's Egyptian gallery. Broad collars were sometimes composed of floral elements sewn on papyrus, and recent research suggests that those found on mummies were made from plants beneficial to health—a *prêt-à-porter* pharmacopoeia for the dead.

The intricate and expensive designs of "pectorals," elaborate pendants hanging from equally elaborate bands, suggest that these pieces of jewellery were reserved for pharaohs and their powerful friends. Most extant examples derive from royal burial goods. King Tutankhamun's pectorals are covered with symbols that extol his personal glory—puns on his name, associations with gods, and references to eternal life.

Bracelets, armlets, and anklets were produced in

many styles (see "Bangles and Beads," page 22). True finger rings, as opposed to a wire wrapped around the finger, first appear during the Middle Kingdom and introduce the well-known scarab into the Egyptian repertoire. Bored lengthwise and threaded to a wire ring, the scarab was often rimmed with a gold mount, but the underside was left visible to be used as a seal. In New Kingdom times, rings became more elaborate and some spectacular examples boast tiny three-dimensional elements such as a pair of prancing horses. Massive stirrup-shaped signets were also popular. So great a number of glazed composition rings were found at the palace of Amunhotep III it is likely they were passed out as banquet favours.

An item of jewellery unique to women was the decorative girdle. This provocative piece rested on the hip bones, a sort of necklace for the hips, and at least one style—decorated with a bead within a bead—was designed to jingle as the wearer walked. Girdles are depicted on nude musicians and dancers in the New Kingdom but they were also worn under diaphanous linen garments.

Earrings were not part of the costume until about 1600 BC even though Egypt's trading partners to the east had been wearing them for centuries. Tomb paintings after that time often depict everyone in earrings, and even the family cat frequently sported a fine gold loop of the same type that graces the cat goddess, Bastet.

COSTUME

PURE WHITE LINEN was the fabric of choice in ancient Egypt. Produced by workshops attached to palaces, temples, estates, and villages, four grades of linen—ordinary, thin, fine thin, and royal—were used to make virtually all clothing. The quality depended on the fineness of the weave which, in royal cloth, could be more than 200 threads per inch. Although wool was certainly produced, there is scant evidence that it was used in garments.

The quality of one's linen was a key indicator of social status: the finer the linen you wore, the richer you were. Women's fashion changed little during the Old and Middle Kingdoms as the basic "little white dress" held sway. This very simple straight sheath or tube skirt reached from just below the breast to the lower calf and had two wide straps fitted over the shoulders to cover the breasts. Though this style is ubiquitous in painting and sculpture, there are no existing examples. Dresses that do survive (the oldest in the world) are constructed on the same principle, substituting a V-necked yoke elongated to form sleeves in place of the shoulder straps. They are also pleated, and although the brittleness and age-browned condition of these garments render them decidedly unattractive, they probably draped rather nicely when worn long ago.

During the Old and Middle Kingdoms, men wore kilts of several varieties and lengths. More formal and complex renditions show pleating and draping and may have been adorned with a beaded

Douglas Champion's representations of life in ancient Egypt are included in the collections of the British Museum and the ROM. His work has been widely exhibited and published.

Bangles and Beads

In keeping with the Egyptians' strong sense of aesthetic balance, bracelets were nearly always worn as matched sets, one on each arm. They could be simple bangles, strings of beads slipped over the hand, or elaborately strung and inlaid gold and silver work, measuring up to 8 cm (3 inches) wide. A chance discovery in 1906 turned up two matching bracelets of Ramesses II. They are a hinged variety made of gold, which has been extensively and intricately decorated with gold granules and very fine plain, beaded, and twisted gold wires—a goldsmith's triumph.

Armlets were often matched sets with bracelets from which they are virtually indistinguishable except when found *in situ*. One such pair from an early 18th-Dynasty queen's burial features two sphinxes flanking her son's cartouche—he was the founder of the Dynasty. Unique designs such as this were not unusual at a time when there was no production-line industry; each hand-crafted piece (at least among expensive items) was an original.

Anklets, too, were matched to pairs of bracelets. Paintings and sculptures indicate that, while popular during earlier periods, anklets went out of fashion in the New Kingdom. A pair found on the mummy of King Pseusennes I, which dates to c. 1000 BC, is curiously anachronistic. Either the veracity of ancient Egyptian art is to be questioned or Pseusennes's status as a god (a king's perquisite) is perhaps here reflected. Gods and goddesses are always portrayed in unchanging archaic style, and in the later periods are often shown wearing anklets.

belt holding a knife with a fancy inlaid handle. Depictions of women in kilts are confined to labourers, dancers, and athletes. It is likely that upper-class women sitting for portraits preferred the conspicuous status of formal dress. Women's swimsuits, to which there is at least one reference in the literature, also likely consisted of simple kilts. Brassieres did not exist, and bare breasts were common in ancient Egypt.

Children are generally shown naked (although not without jewellery) in visual arts. There are examples of children's clothing—winter weather would have demanded it—but it is likely that children often went *au naturel*. A weft-looping technique produced a terry-like fabric used to make warm clothing. There is a charming child's tunic of this weave housed in the Egyptian Museum in Cairo.

The universally worn bag tunic was nothing more than a large T-shirt made from a folded rectangle of cloth. It became popular in the New Kingdom and remained in use right through to Greco-Roman times. Women seem to have stayed with a very plain full-length version, while men of the 18th Dynasty developed a sartorial savvy with the garment. They added elaborate sashes and expensive, colourful decorative bands, which were sewn to the edges.

The great affluence of the New Kingdom, spurred by conquest and trade to the east and south, brought with it new goods and technology. This not only provided the upper classes with the means to afford voluminous quantities of fine linen to drape around their well-fed frames, but also brought new weaving techniques to complement their dress. Newly imported Syrian technologies—tapestry, card weaving, and embroidery—were applied to tunics. The campaigns of Thutmose III (c. 1450 BC) brought back hundreds of Syrian weavers and their "needling" wives to supply the king and his friends with new marks of distinction. A multi-coloured card-woven sash of Ramesses III (c. 1175 BC) is some 5 metres (16½ feet) in length, and the tapestry and embroidery bands in a tunic belonging to King Tutankhamun incorporate both Egyptian and Syrian motifs in red, blue, green, and yellow. The sudden

Left: Earrings, such as these of gold from the late period, did not become part of the costume in Egypt until about 1600 BC. Right: These glass ear studs could also be worn suspended, pendant-style, from a gold wire.

explosion of colour in fabrics probably also reflects imported technology. Although some coloured fabric—usually blue or grey—is known from before the New Kingdom, it was used sparingly, suggesting great effort or expense.

In the New Kingdom, women wore a sari-like garment made from one or two large rectangular pieces of soft, often fringed, linen. The effect is surprisingly like the opulent, flowing lines of the Indian sari, although the Egyptian version remained stark white, enhanced by coloured sashes and jewellery.

Other items of apparel included caps and kerchiefs, shawls and cloaks, loincloths and aprons. Men's kilts were adorned with beaded or tapestry "aprons," which resembled Scottish sporrans, hanging from their belts. Gloves and socks (tailored, not knitted) were found in King Tutankhamun's wardrobe but were most likely a royal prerogative. The tomb of one of his father's officials depicts a royal presentation of gloves, a sign of his great importance.

Footwear was simple. Sandals made of fibre or leather appear only sporadically in the artistic record and invariably consist of a thong that threads between the large and second toe and attaches to a single strap over the instep. While lower echelons are always shown barefoot, the upper classes may be portrayed with or without their sandals. A beautiful pink leather pair is part of a noble lady's tomb equipment, now at the British Museum.

COSMETICS

Ancient Egyptians seldom left home without make-up. Everyone, children included, wore eyeliner, usually made from a lead-and-sulphur compound called galena. While such prolonged use of lead may have had some deleterious effect, the Egyptians believed it to be beneficial and they wore it daily. Called *mesdemet*, eyeliner was often stored in highly decorative containers. Some had multiple compartments, inscribed for "every day," for each season, and "special"—perhaps a drop of a different precious oil made each unique. *Mesdemet* was liberally applied all around the eye, sometimes extending outwards at the corners. The so-called cosmetic line (an exaggerated extension) that many people associate with ancient Egypt was reserved during the Old Kingdom for depictions of royalty or gods, but was later usurped by commoners. A delicately elongated inner corner extension was in vogue during the Old Kingdom, as was a green eye-shadow made from ground malachite and applied liberally both under the eye and on the eyelid. Some mummies bear evidence of henna-stained fingernails, an early form of nail polish.

Egyptian perfume was prized throughout the ancient world. In addition to enhancing body scent, perfumed oil and unguents were also used to lubricate the body for protection against the sun and dry climate. Made from animal fats, unguents were scented with flowers and spices. Lilies, the most popular ingredient, were combined with honey, myrrh, cardamom, cinnamon, and crocus to produce a sweet and pungent fragrance.

Virtually every painted tomb in ancient Egypt depicted a banquet scene, attesting to the importance of such gatherings where social status was proclaimed by one's manner of dress, weave of linen, and fineness of jewellery. Such gala events provided the ideal setting in which to flaunt one's style.

In Shakespeare's *Antony and Cleopatra*, the fabled Egyptian glamour queen says to her lover, "Eternity was in our lips and eyes." It is, in part, their eye for beauty that keeps this ancient people vivid in our imaginations.

Web Links: Information on ancient Egyptian technology can be found at http://channels.reedelsevier.com/ScienceRTW/ElsevierScience/docs/n9021101.html. For a listing of resources on Egypt, try http://pharos.bu.edu/Egypt/Home.html#egyptology.

Dinocarids

The First Monster Predators on Earth

Believed to be sea cucumbers, jellyfish, worms, and shrimp at various points since they were first discovered in 1886, the nature and appearance of these extinct prehistoric marine dwellers have confounded scientists for a century

By Des Collins. Illustrations by Marianne Collins

Scientific certainty is an elusive quantity, especially so when the specimen under study is more than half a billion years old. And sometimes, all the pieces of the puzzle aren't really there, even when they seem to be.

In 1986, when I wrote "The Great *Anomalocaris* Mystery—How a Shrimp Became the World's First Monster" (*Rotunda*, Winter 1986/87), I had no inkling that this was

long-extinct have been

BRIAN BOYLE, ROM

The most complete *Anomalocaris canadensis* specimen known to date was collected in 1991 by a ROM field crew, finally revealing the mysterious creature's true appearance.

Inset: Artist Marianne Collins's reconstruction of *Anomalocaris*.

just the beginning of the story. Since then, a series of discoveries, some of them made by ROM scientists, has revealed the presence in Cambrian seas of a major group of large predatory creatures, the dinocarids (terrible crabs). As the much younger dinosaurs (terrible lizards) would do on land 300 million years later, the dinocarids dominated and preyed upon the animal communities of their time.

And like the dinosaurs, the long-extinct, completely unknown dinocarids have been misinterpreted for many years. In "The Great *Anomalocaris* Mystery," I reported that the claws of *Anomalocaris canadensis* were discovered in 1886 in the Burgess Shale of Mt. Stephen, British Columbia, by R. G. McConnell of the Geological Survey of Canada (GSC). In 1892 the claws were described by GSC palaeontologist Joseph Whiteaves as the abdomen and tail of a crustacean, and in 1928 were attached to the carapace of the arthropod *Tuzoia* by the Danish palaeontologist Kai Henriksen. An almost complete *Anomalocaris* specimen was collected by the GSC in 1967 and was used by Harry Whittington of Cambridge University in 1982 to attempt a complete reconstruction.

A second thread of the story outlined how the discoverer of the main Burgess Shale site, Charles D. Walcott from the Smithsonian Institution, described the radiating jaws of *Anomalocaris* as a jellyfish, which he called *Peytoia*, and a poorly preserved anomalocarid, which he named *Laggania*, as a sea cucumber. Subsequently, in 1978, a Cambridge graduate student named Simon Conway Morris proposed that *Laggania* was actually the jellyfish *Peytoia* superimposed on a sponge. Finally, in 1985, Harry Whittington and another of his graduate students, Derek Briggs, brought all of the pieces of the puzzle together as two species, *Anomalocaris canadensis* and *Anomalocaris nathorsti* (for *Laggania*), belonging to "a hitherto unknown phylum." Thus, in my 1986 *Rotunda* article, I produced a reconstruction of both species, and reported that the mystery of *Anomalocaris* had been solved. I was wrong.

The first indication of something amiss

Like the dinosaurs, the completely unknown dinocarids misinterpreted for many years

with the solution to the *Anomalocaris* mystery came from a Swedish palaeontologist, Jan Bergstrom. From a careful analysis of the *Anomalocaris* specimens described by Whittington and Briggs, Bergstrom concluded that both species had jointed legs, and were therefore arthropods. Bergstrom was mistaken on the jointed legs, but correct in recognizing specimens that didn't fit Whittington and Briggs's reconstruction. In their study, they had included specimens that belonged to a third anomalocarid still to be described.

I became directly involved in the research on August 27, 1991. On that day the Royal Ontario Museum crew excavating on Fossil Ridge in the Burgess Shale uncovered the most complete *Anomalocaris* ever found. Surprisingly, this specimen, a top view, shows that *Anomalocaris* had a tail composed of six vanes, very much like the tail on another Burgess Shale conundrum, *Opabinia*. Its two claws trail to the rear, and its head is short and broad. A second specimen discovered in 1991 is a bottom view of the front half of the animal, this one with the two claws thrust forward, and revealing two eyes on stalks. In contrast to the first specimen, the head of the second is long and narrow, demonstrating that it was flexible and extensible. Evidently, when *Anomalocaris* was just cruising around, its claws trailed back and its head was compressed. When it spotted its prey, *Anomalocaris* would extend its head, unwind its claws, and thrust them forward, grasping for its target somewhat in the way that a cuttlefish uses its two long tentacles to reach for its prey. Further specimens of *Anomalocaris* were found in 1992. On one of them, nicknamed "Bullwinkle," collected on August 4, the claws were wide open. A new reconstruction by artist Marianne Collins, based on these new specimens, suggests that *Anomalocaris* was, in appearance, even more bizarre than earlier imagined.

A comparison with the second species illustrated in the 1986 article, *Anomalocaris nathorsti*, shows that the two are so different in appearance that they should be classified in separate genera. *Anomalocaris nathorsti* thus returned to the name it was first given by Walcott in 1911, *Laggania cambria*, even though he thought that it was a sea cucumber.

Knowing what *Anomalocaris* and *Laggania* looked like leads to an obvious question: What are they? Whittington and Briggs thought that they belonged to a previously unknown animal phylum. If this were so, however, there would be two animal phyla characterized by jointed limbs. It is simpler to consider that *Anomalocaris* and *Laggania* belong to an extinct class of arthropods characterized by circular jaws of radiating teeth. In 1996, I proposed the name "Dinocarida" (terrible crabs) for these animals, indicating their role in Cambrian seas as monster predators much larger than their prey, a role similar to that of dinosaurs. Known from Cambrian rocks not only in British Columbia but elsewhere in North America—Pennsylvania, Utah, and California—and also from Poland, South Australia, Greenland, and notably, from southwest China, dinocarids were a major group of predators throughout the world's oceans half a billion years ago.

The ROM's first excavation in the Burgess Shale took place in the summer of 1983. Among the crew that year was Chen Junyuan, a colleague from the Nanjing Institute of Geology and

This *Anomalocaris* reconstruction, on the cover of *Time*, is actually that of *Laggania* with an extra set of teeth that we now know belong to the animal *Hurdia*, just one of the many misconceptions of *Anomalocaris*.

Opening Spread:
This Cambrian seafloor community, in which dinocarid predators *Laggania* and *Anomalocaris* stalk their prey, was reconstructed from fossil specimens found in the Walcott Quarry, Burgess Shale, British Columbia.

With their radiating circular jaws, and large spiny claws, make fine ferocious-looking

WEB LINKS

For further references on the Burgess Shale, contact: http://www.scienceweb.org/burgess/contents.html.
For links to Canadian paleontology organizations and Web sites, try http://nrn1.nrcan.gc.ca:80/gsc/calgary/paleo/links-cd.htm#expertise.

Palaeontology. Chen had spent the previous year at the ROM studying fossil nautiloid molluscs. When he left for China at the end of the 1983 season, he observed that because there is so much Cambrian sedimentary rock outcropping in China, there should be a site there similar to the Burgess Shale. On July 1, 1984, a colleague of Chen's, Hou Xianguang, discovered just such a locality in Yunnan Province in southwest China. It contains a soft-bodied fauna, including many Burgess Shale genera, even though it is older than the Canadian fauna by 15 million to 20 million years.

I have visited Chen twice since then and was allowed the privilege of photographing some of his specimens. Among them are six dinocarid species known mostly from partial remains, especially claws. The most complete is a species of *Anomalocaris* called *Anomalocaris saron*, which is much like the Burgess Shale's *Anomalocaris canadensis*. The second-most complete dinocarid, called *Parapeytoia yunnanensis* by Hou and two Swedish colleagues, including Jan Bergstrom, is quite extraordinary in appearance: it has toothed jointed limbs typical of arthropods, large claws with opposing spines, and circular jaws on a rear-facing headlike structure, and it seems to lack eyes. It is likely that the reconstruction will change with the discovery of more specimens. The jointed limbs confirm the arthropod affinities of the dinocarids, although perversely, Hou and his colleagues consider the dinocarids to be aschelminth worms.

In the Burgess Shale, there are at least three or four other dinocarids still to be fully discovered and described. The best known is *Hurdia*. Reconstructing *Hurdia* is proving to be similar to reconstructing *Anomalocaris*: a matter of assembling pieces already described as something else, and preferably, finding a specimen with all of the pieces in place.

In 1912, Walcott described two triangular fossils as the carapaces of two species of *Hurdia*: *Hurdia victoria* and *Hurdia triangulata*. The probable claws of *Hurdia* had been described by Walcott in the previous year as the claws of the large arthropod *Sidneyia*. Walcott never actually saw these claws on any *Sidneyia* specimen. But because the claws are jointed and hence must have come from a large arthropod, and because *Sidneyia* was the largest Burgess Shale arthropod described by Walcott, he considered that the claws must belong to *Sidneyia*. On the basis of this association, he called *Sidneyia* "The King of the Animal World 15 Million Years Ago" in a *National Geographic* article published in June 1911. He was wrong about the age, too, by about 490 million years. In 1917, Walcott's former assistant, Lancaster Burling, published a reconstruction of *Sidneyia* with *Hurdia* claws in the October issue of the *Ottawa Naturalist*.

The next part of *Hurdia* to be described was what Ian Rolfe, a Scottish palaeontologist studying the Burgess Shale collection at Harvard University, in 1962 considered to be the carapace of an arthropod, which he called *Proboscicaris*. We now know that two *Proboscicaris* carapaces, along with the *Hurdia* carapace, make up a three-part carapace at the front of the *Hurdia* animal.

The last parts described were the jaws and teeth. In 1985, Whittington and Briggs believed the jaws "showing additional groups of spines within the aperture" to be those of the

WATERMARK: *PARAPEYTOIA YUNNANENSIS*

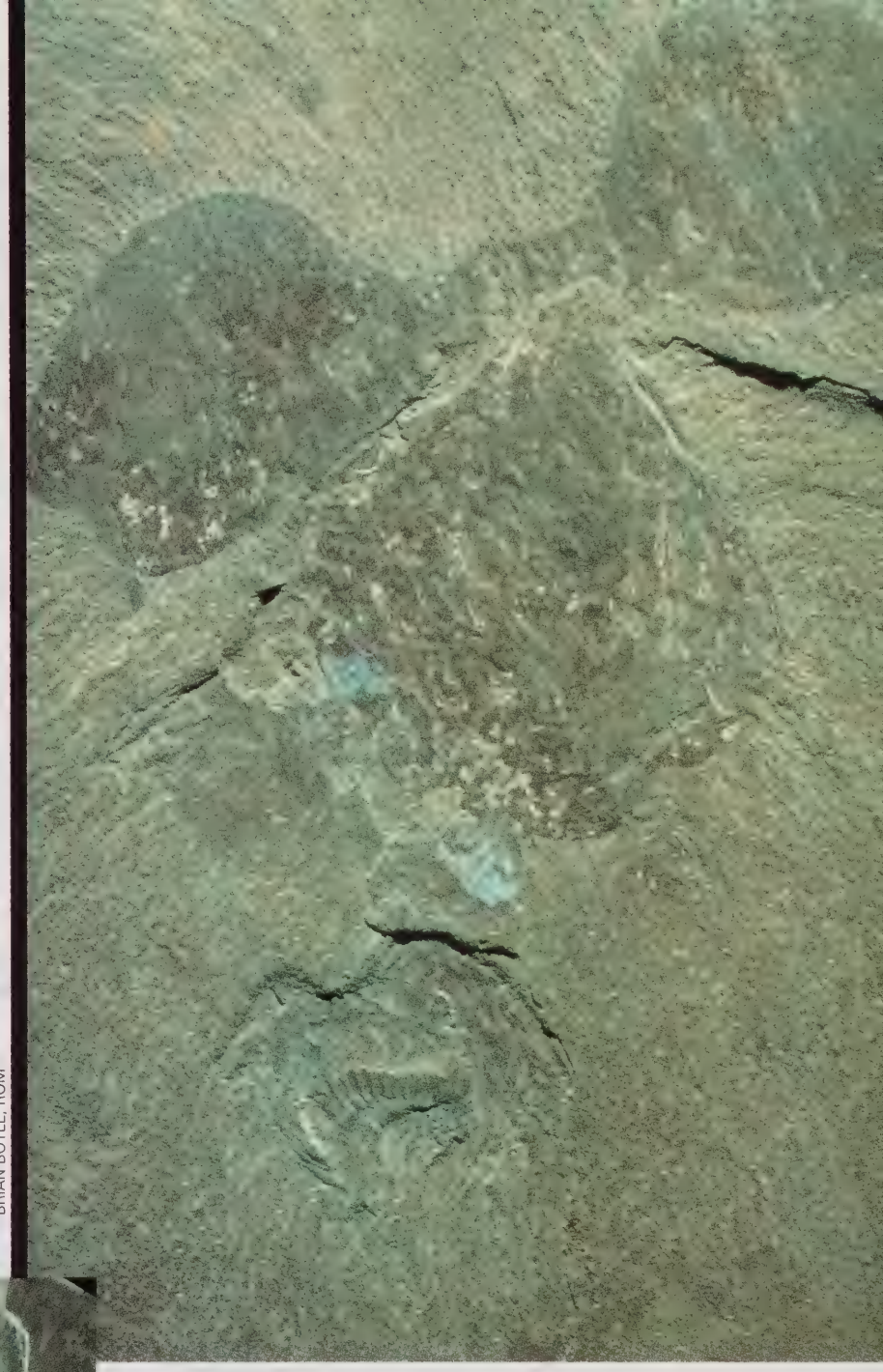
teeth, dinocarids predators

animal they called *Anomalocaris nathorsti*. What the photograph of their specimen did not show was that part of the jaws had been covered by a *Hurdia* carapace that had been excavated away to reveal the whole jaw. Other ROM specimens show the same association of *Hurdia* carapaces with circular jaws bearing extra teeth, so it is evident that these jaws belong to *Hurdia*. A reconstruction of an *Anomalocaris* bearing the circular jaws with extra rows of teeth inside appeared on the cover of *Time* magazine on December 4, 1995. The reconstruction is incorrect.

It is evident then that there have been major changes in our perception of early animal life on Earth since 1986. Far from solving the *Anomalocaris* mystery, the 1985 description by Whittington and Briggs led instead to the discovery of a major group of monster predators, prowling the world's oceans 505 million years ago.

As a long-extinct, completely unknown group of predators that was misinterpreted for many years, the dinocarids are the invertebrate equivalent of the dinosaurs. Just as the interpretation of dinosaurs involved some of the best natural historians of the 19th century, so has interpreting the dinocarids engaged some of the best palaeontologists of the 20th. In the 21st century, we can anticipate that the dinocarids will take their place in the panorama of life on Earth. Moreover, as more kinds of dinocarids are discovered, they have the potential to rival dinosaurs some day in popularity. With a size of up to a metre in length, dinocarids are not as large, but they are much older than dinosaurs, and with their radiating teeth, circular jaws, and large spiny claws they make fine ferocious-looking predators.

Soon, the dinocarids will make their public debut in Toronto. The Burgess Shale exhibit currently being planned for a new ROM gallery, First Monsters! The Fossil Record, will display specimens of *Anomalocaris canadensis* and *Laggania cambria*, along with reconstructions of their communities and the creatures on which they preyed in Cambrian seas.

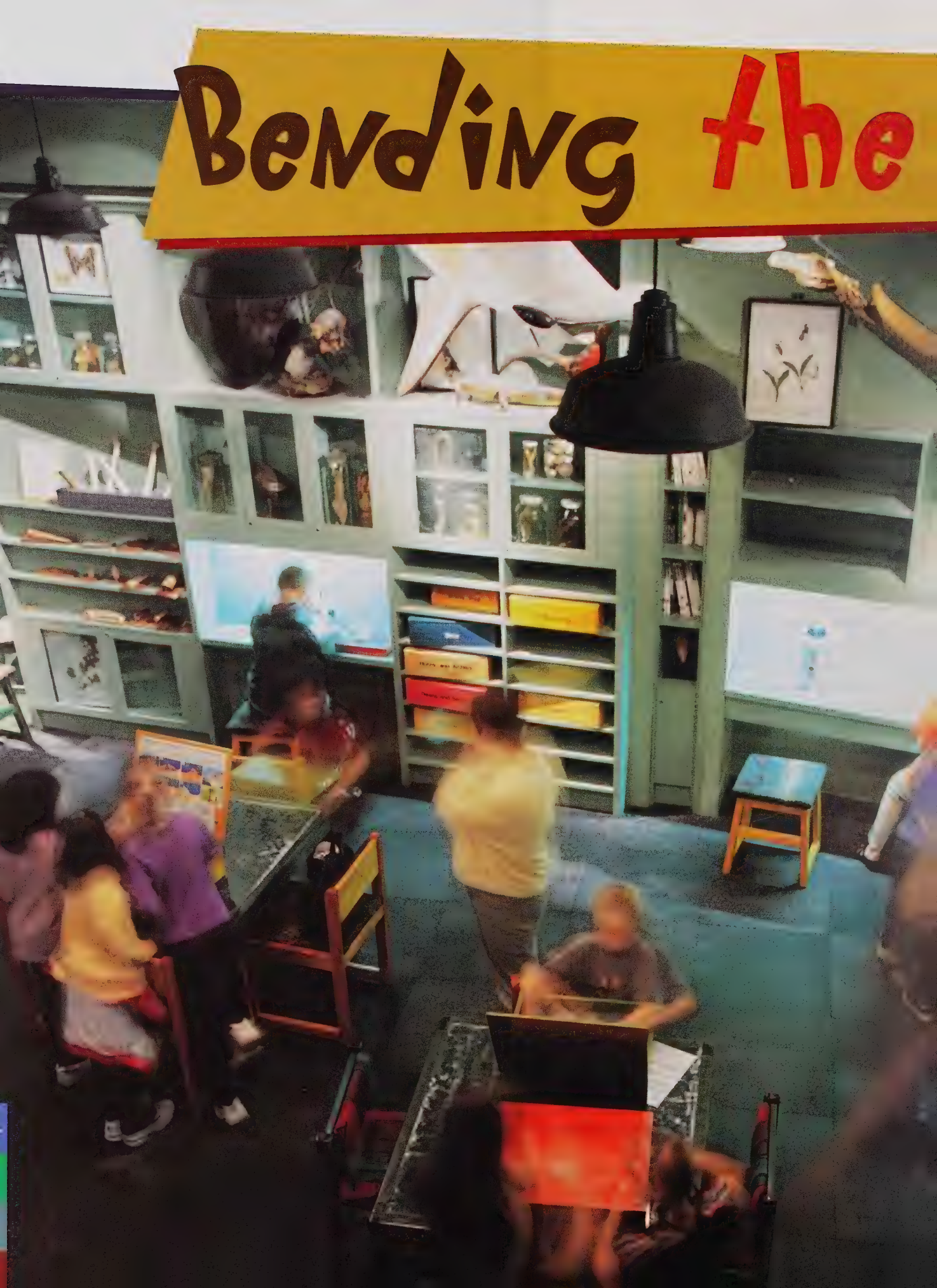


BRIAN BOYLE, ROM

DES COLLINS, ROM

This *Hurdia* specimen shows the three-part carapace and radiating jaws cupped between two claws hanging down.

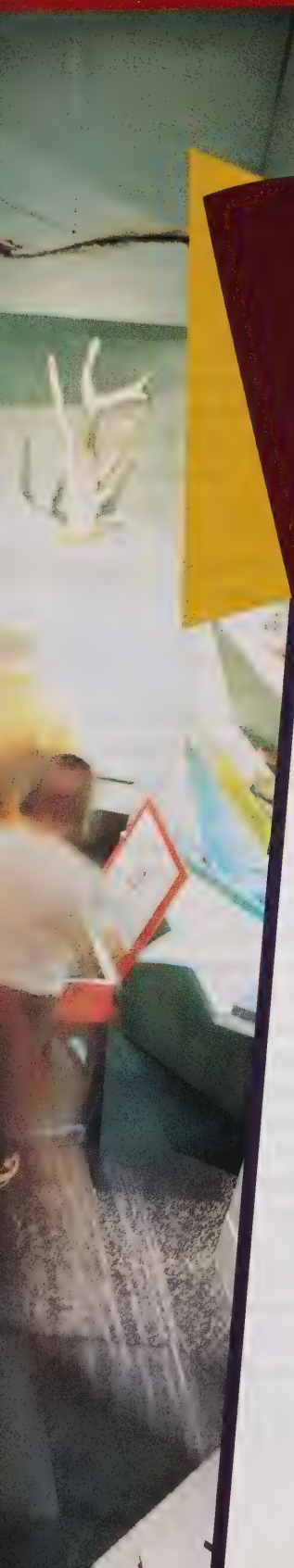
Inset: Whittington and Briggs thought these *Hurdia* jaws belonged to *Anomalocaris*, even though they had to excavate the *Hurdia* carapace to expose them.


Bending the

Learning Curve

The ROM's Discovery Gallery has evolved over a quarter century as the Museum cultivated new ways to educate children

By Betty Stein



Psychologist Caryl Marsh had a hunch she was on to something after noticing the attention being paid to a small exhibit of unlabelled boxes at the Smithsonian's Anacostia Neighborhood Museum. She was right. Her observation has led to profound changes in the way museums—including the ROM—engage their visitors.

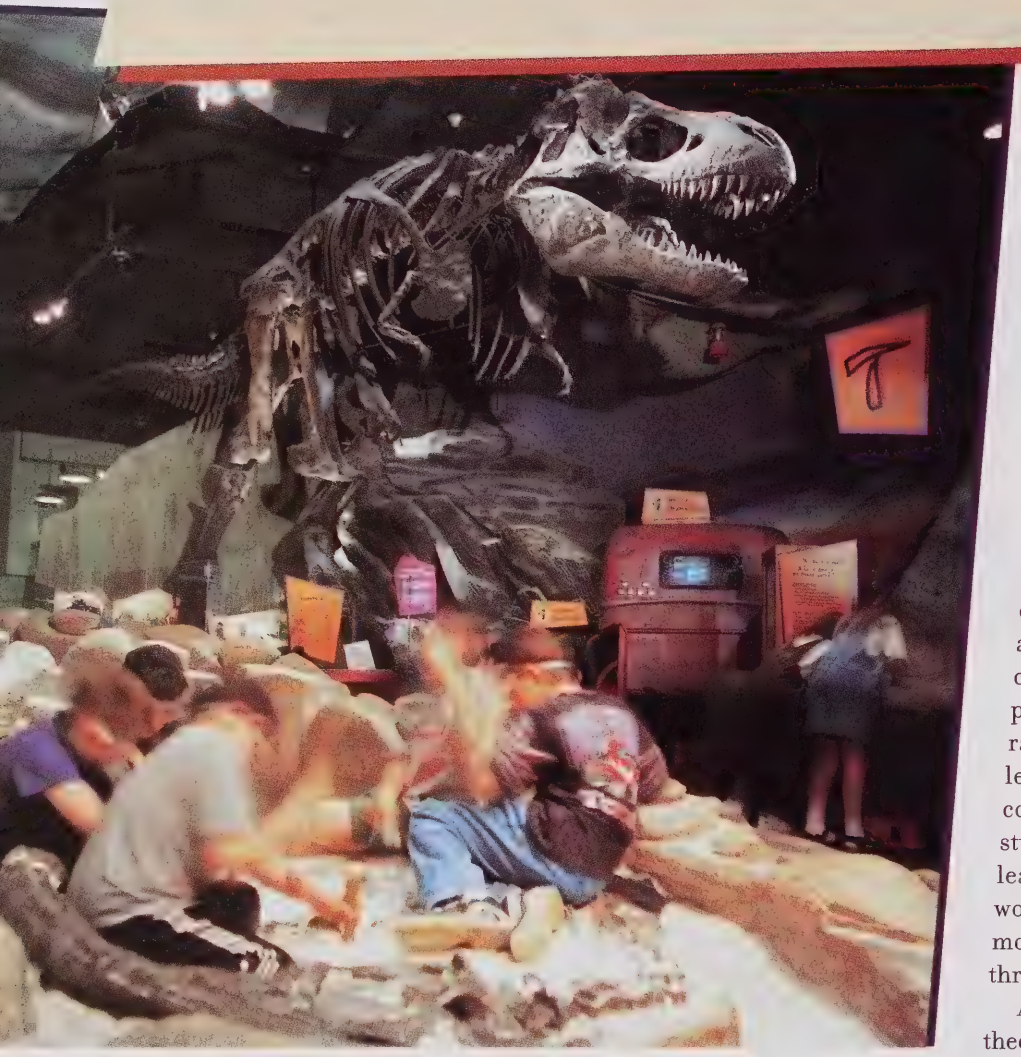
The boxes, which contained a variety of materials, proved fascinating to the public, who were intrigued by the opportunity to touch and handle artifacts. After listening to people's questions and comments, Marsh became convinced that the museum could provide a remarkable experience by adding more information to the boxes and making them accessible for study in a structured setting, with staff available to answer questions.

The model for this completely new kind of hands-on learning was established in 1971 when Marsh joined forces with Judith White from the Boston Children's Museum to put her idea into action. Together they created a Discovery Room for the Smithsonian's Museum of Natural History, the first museum space where visitors could touch and examine objects that had previously been kept locked up behind glass. The concept caught on and in the mid-1970s many North American museums, including the Field Museum of Natural History in Chicago, the American Museum of Natural History in New York, the California Academy of Science in San Diego, and the ROM, followed suit with their own discovery rooms.

It's the evolution of that early space, which first opened at the Museum in 1977, that you see today in its magnificent new format on the second floor. The Discovery Gallery's dramatic environments and experiential approach allow visitors to explore and understand the ROM's collections and research on their own terms. While fun is definitely part of the learning equation, by actively participating—examining specimens under a microscope, putting together a cat skeleton, or trying to decipher the meaning of hand positions in a series of statues representing Buddha—young visitors acquire a

PHOTOGRAPHY: BRIAN BOYLE, ROM

While fun is definitely part of the learning equation, acquire a deeper, more personal, and therefore more



deeper, more personal, and therefore more memorable, understanding of the material.

Such an approach to learning emerged in the late 19th and early 20th centuries, advocated by a number of educational theorists such as John Dewey (1902), psychologists at the Bureau of Educational Experiments in New York (1916), and Jean Piaget (1926). These thinkers spurned the traditional notion of children as passive receptacles of data, proposing instead that young minds actively gain knowledge by manipulating, exploring, and discovering. Their reforms, together with the recognition that children's need to participate was not being addressed in traditional educational environments, inspired a series of museums designed specifically for children—in Voor Het Onderwijs (the Netherlands) in 1904, Detroit and Boston in 1917, and Indianapolis in 1927.

Despite this progress, emphasis on the needs of the learner and learning-by-doing waned, reappearing only with the next wave of progressive educational reform in the 1960s and 1970s. Discovery learning theory is generally credited to Jerome Bruner, an American psychologist, who felt that the role of education was to instill inquiry and problem-solving skills by encouraging students to actively participate in the learning process, rather than passively listening to lectures or learning by rote. After conducting numerous tests and studies, he concluded that children learning in more experiential ways would become more observant and more motivated to explore topics through question and answer.

As discovery learning moved from theory into practice, many educational institutions and museums looked for new venues to stimulate curiosity and motivate learning. The innovative experiments of Caryl Marsh at the Smithsonian (those unlabelled boxes) and of Michael Spock at the Boston Children's Museum quickly revolutionized the interpretive landscape. Spock introduced exhibits that encouraged visitors to explore themes through fun settings. In one of his best-known installations, Japan could be experienced in recreated environments—sitting in a Japanese subway car, for example, or checking out the menu in a Japanese café while listening to music. These direct-experience interactive exhibits proved so successful that they created a renewed explosion of interest in children's museums. There are now

by actively participating, young visitors memorable, understanding of the material

more than 400 of them in North America, with many more being planned, making this one of the fastest-growing areas in the museum field.

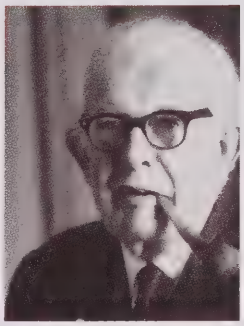
The ROM's Discovery Room was first conceived in 1976 when members of the Education Department returned from a visit to the Smithsonian convinced that the concept would be a hit with staff and visitors. An experimental gallery was established opposite the Theatre ROM, stocked with artifacts and other materials from and about the ROM's collections. The room's 144 square metres (1600 square feet) allowed for only 20 visitors at a time, but under minimum supervision they could handle and interact with Museum artifacts that had been specially chosen for their relationship to discovery-learning approaches and their sensory appeal. Most popular were the discovery boxes, similar to those at the Smithsonian, and stumpers—unusual objects that challenged visitors' powers of deduction. Reaction was very positive, although the room was more successful with children, who easily became involved in handling artifacts, than with adults, who may have seen it primarily as a children's space.

After the Museum underwent a major renovation in the early 1980s, a somewhat larger Discovery Centre opened in 1983 in a basement location. It was immensely popular, and attracted the attention of museum staff and educators all over the world who were interested in developing similar galleries. Ruth Freeman, the Discovery Centre's manager at the time, created a practical manual that became essential reading. It outlined the educational theory behind discovery learning and its practical adaptation to interactive museum displays. It also documented the numerous evaluations, studies, and changes that had taken place in the ROM's Discovery spaces over the years.

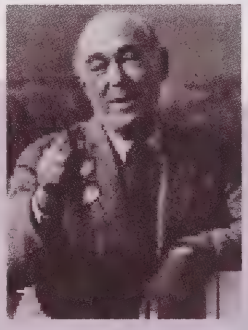
Freeman's approach to discovery learning drew on the theories of American educational psychologist Muska Mosston, who divided discovery learning into three categories. The first of them, guided discovery, was dominant in the gallery. Guided discovery takes learners step-by-logical-step through a series of discoveries towards a predetermined goal. In problem solving, the second category, a question is posed to the learner who engages in active inquiry to come up with one or more solutions. Learners take their own path towards discovery in this process and are free to make decisions about the subject matter. In the third category, the individual learner-designed program, learners pose problems and pursue solutions independently. Because of the structured nature of the Discovery Centre, it was not thought that this form of learning would be particularly applicable, although if visitors bypassed the provided interpretive text, they could in fact pursue their own independent inquiry.

Studies indicated that this is exactly what many visitors did, and they reported enjoying the experience as well as learning a great deal. Family members appreciated the shared experience of guiding each other through the materials. For the most part, they did not experience the items sequentially, but appeared rather to reorganize and select according to their personal skills, interests, and needs.

About the same time that these observations were being made in the gallery, Howard Gardner, a respected cognitive psychologist from Harvard University, proposed that people possess at least seven intelligences, including linguistic, logical, visual, spatial, mathematical, kinesthetic, and musical. The degree to which each of these multiple intelligences are developed in individuals accounts for the differences in the ways people experience, process, and retrieve information. The degree of freedom visitors had in the Discovery Centre allowed them to follow their own needs and interests, and to enjoy, synthesize, and build knowledge by taking advantage of their own innate capacities.



LANDENBERG / FONDATION ARCHIVES JEAN PIAGET, GENEVA



SUE KLEMENS

© JERRY BAUER, 1994

Groundbreaking research by Jean Piaget (top), Jerome Bruner (middle) and Howard Gardner led to a dramatic rethinking of childhood education.

As discovery Learning moved from theory into practice, and museums Looked for new venues to stimuLate

In the mid-1990s, new gallery manager Melanie Fernandez sought new avenues of experimentation and worked with the community to develop some very exciting joint hands-on exhibitions and programs. She developed the first-ever exhibits at the ROM about Ontario's Black history and the Holocaust, held concerts in the gallery during a display of Chinese Traditional Musical Instruments, and grew zebra mussels in a tank during an exhibit about the Great Lakes to demonstrate the very real ecological threat they posed.

When I was appointed manager in 1995, the gallery became an active supporter of the Museum's temporary exhibit program. We also sought to gradually eliminate the structured pathways in the gallery's educational materials to allow alternative wayfinding. One or two questions were provided that would get the visitor's attention and kindle further interest in the topic. A multi-layered approach to text was also developed: the first response level was a concise statement, followed by the opportunity for closer examination using a microscope, magnifying glass, game, or activity. A more informative text card or panel supported these investigations.

The gallery's work with school groups also took a new direction. Experiments in educational theory by George Hein in the United States and Eileen Hooper Greenhill in the United Kingdom indicated a shift away from presenting material through a single didactic format to a more varied and immersive approach that attempted to serve the needs of a variety of learners. Staff were inspired to conduct their own experiments, from which they developed The Discovery Activity for School Groups in the spring of 1996. It was designed to enhance a self-directed approach to learning by cultivating and reinforcing important research skills such as questioning, making observations and associations, comparing, and drawing conclusions. Every session started with small group discussions with a trained leader, followed by independent exploration. A follow-up discussion reinforced the significance of each student's experience .

All of these efforts paid off. Attendance in the Discovery Centre nearly doubled and the visitor comment books were filled with positive feedback. Museum professionals and interns, including staff of other discovery galleries, con-

many educational institutions curiosity and motivate learning

tinued to visit to learn the secrets of the ROM's success. Design firms brought their clients here.

This increased interest in the centre and in discovery learning helped garner support for moving the gallery to its current, more prominent location. The new gallery built on the ROM's own experience and drew inspiration from others. Discovery staff revisited the roots of discovery learning, and travelled to 35 institutions in Canada, the United States, and the United Kingdom. From our own studies, we knew that people appreciated the chance to get involved in activities related to artifacts and specimens, such as designing their own Chinese robe or trying on real chain mail.

From this research, a vision for the new Discovery Gallery emerged in which contextual environments would set the stage for visitors to choose activities that would best suit their own needs for fun and learning. A theatre set designer was hired to create the gallery's fanciful environments, which allow visitors to be immersed in discovery in a more playful way. Texts with key questions engage visitors in problem-solving and active inquiry, allowing a great deal of latitude in approaches to learning. Text is provided at various levels to allow visitors of all ages to participate. There are also plenty of hands-on opportunities that allow visitors to use artifacts and specimens as resources for learning: they can test the phosphorescence of rocks; put together their own collections in the Collector's Corner; or don reproduction armour to roleplay. For those who like to watch and listen, videos highlight the research of ROM curators. By doing, looking, handling, hearing, creating, imagining, and sharing, young visitors are having a great time as they build knowledge.

Last year the old Discovery Centre hosted almost 140,000 visits. This year the gallery is expected to host 300,000. Visitors continue to tell us how "cool" they think the space is. Providing more opportunities for active involvement in the ROM's galleries is a wonderful way to bring the Museum's research and collections to life for all visitors. But having fun does not mean that we have forgotten the serious business of how children and adults learn in museums.

Opening in October, another new ROM gallery, Hands-On Biodiversity, will use these same immersive and interactive techniques to explore the diversity and inter-relationships of life on Earth.

A Room of Their Own

When the ROM's Discovery Room opened in 1977, children under the age of six were not permitted inside. It was felt that they would require more supervision than was available. Young ones could stay in the hallway with a parent and play with materials from a small cart. As attendance increased, the cart was enlarged. With the help of a museum studies intern from the Netherlands, a handsome cart containing 14 preschool activities was developed, tested, and kept in constant use. By the mid-90s, the hall was becoming increasingly congested and staff were concerned for the small children's safety.

Clearly another solution was required. An experimental space for younger children and their caregivers was set up in an education classroom across the hall in 1996. Although the Discovery Centre was able to use the room only on Tuesday evenings, weekends, and summer holidays, it was an immediate success, hosting 27,000 enthusiastic visitors in the first year. After much testing and experimentation, five-year-olds were admitted into the centre, and the pre-school gallery focused on the needs of children aged four and under.

Although the gallery would eventually be open to all ages, this space was the forerunner of Franklin's World, the special pre-school area in the new Discovery Gallery based on the Canadian children's books about Franklin the turtle. Here, children can dress up as a butterfly or dinosaur, engage in active physical play by climbing and sliding, or play with puppets that resemble real mammals, birds, and snakes from the ROM's collections.

EARTH

The story of life and its impact on Earth is told in the ROM's new Dynamic Earth: Inco Limited Gallery of Earth Sciences through a series of pictures by children's illustrator Blair Drawson narrated by two whimsical characters: Trog, who represents geological forces, and Algie, who represents life.

coming together

molten earth

ALIEN. To many, the word suggests Mars, and perhaps even diminutive humanoids descending from flying saucers, looking to meet with Earthly leaders. But it's a term few would associate with Earth itself. In fact, among its planetary companions Earth *is* the strange one. And it is life itself that makes our planet "alien" in our solar system.

Earth's surface is largely covered with water, and its atmosphere is rich in free oxygen, an extremely reactive gas that constantly strives to combine with other elements. For comparison, look at our nearest planetary neighbours: while there is water on Mars, it is frozen—and beneath the surface; the atmosphere of Venus is 90 per cent carbon dioxide (compared to Earth's 0.035 per cent) and many times denser. Earth is also the only planet known today to support life. Coincidence? Probably not.

Like the rest of the planets, Earth began about 4.6 billion (4600 million) years ago when trillions of space rocks collided to form large masses. Heat from radioactivity and the forces of gravity caused the rocks to melt—and meld—and their minerals to differentiate into distinct zones: core, mantle, and crust. Meteoroids, the space rocks left over from these early turbulent times, occasionally still crash to Earth. Presumed to be parts of small planets that formed around the same time as Earth, they hold important clues about the composition of our planet's interior. The iron and iron-nickel composition of meteorites, for example, corresponds with the findings of seismic studies of Earth's interior that suggest our planet has a dense iron core.

The emergence of life

THE ALIEN PLANET

and how it separated Earth from the planetary pack

By Janet Waddington. Illustrations by Blair Drawson

As the surface of the newly formed Earth gradually cooled, a solid crust began to form. Steam and other gases released from the molten Earth were held in close proximity by gravity. For millions of years, the planet's surface would have been bombarded by meteors repeatedly melting and remelting the crust and blasting the beginnings of the atmosphere into space. Eventually, this bombardment slowed and the newly hardened crust stabilized. Earth's history could now be recorded, preserved in the rocks of its crust.

By studying these rocks, the only tangible evidence of the past, geologists have unravelled some puzzles about Earth's beginnings. Rocks can tell us much about early environments and some of them even contain the means, through radioactive minerals, for accurately determining how long ago they formed. In the ROM's geochronology lab, scientists extract minute individual crystals of the mineral zircon from sample rocks. Zircon contains the radioactive element uranium, which changes very slowly but at a known constant rate to a particular form of lead. This lead is trapped and held within the crystal. By measuring the amounts of uranium and lead in the crystal, assuming that all of the lead came from uranium decay, it is possible to calculate how long it has taken the lead to form, and thereby the age of the crystal.

Some samples of sandstone from Australia, composed of fragments weathered from much older rocks, contain sand grains that have been dated in the laboratory to 4.2 billion years ago. These must be some of the very oldest remnants of Earth's first solid surface.

Rocks also show us that, even after it had cooled, the surface of earliest Earth was quite unlike what we know today. Volcanoes belched out gases, including vast amounts of steam, which condensed to fall as rain and collected into oceans. Evidence of liquid water is captured in very old sedimentary rocks; they formed the same way as those of today, from alluvium deposited by water. That means the Earth's surface temperature must have been between 0°C and 100°C—too warm for the water to freeze and too cool for it to boil away. Earth's interior, however, was much hotter than it is now. Ancient volcanic rocks called komatiites bear a distinctive crystal pattern that forms only from magma heated to white-hot temperatures. Volcanoes on early Earth must have erupted lava at a temperture of 1600°C, while hot volcanoes today register "only" about 1200°C. Scientists believe that the atmosphere of earliest Earth must have been much like that of Venus today—dense, formed mostly of carbon dioxide with enough other gases, such as methane, hydrogen sulphide, and sulphur dioxide, to make it a most unpleasant place by our standards. Perhaps its most significant feature was its lack of free atmospheric oxygen, without which we could not survive. This lack is evidenced by the mineral content of certain sedimentary rocks—minerals that were once in contact with the atmosphere but could not have existed in the presence of oxygen. (These minerals must have been "locked in stone" before oxygen appeared.)

It was in this unlikely environment that life first emerged. It is possible that life may have begun many times over, only to be obliterated by the meteorites that constantly reshaped the surface of the young Earth. Life may have begun in the hot sulphur springs where gases bubbled out from deep within the Earth; it may have begun in pools of chemical-rich water bathed in UV radiation from the sun or blasted by the electrical energy of lightning; it may have started inside glacial ice or deep within the rocks. The first building blocks of life may even have been brought to Earth in space dust. We may never know exactly where life first appeared.

We do know that life on Earth must be almost as old as Earth's crust. As soon as liquid water existed, life could take hold. The oldest known rocks containing evidence of life, from a place called North Pole in Australia, are 3.8 billion years old, and older examples may yet be found. Using an electron microscope to examine paper-thin slices of this chert, scientists have discovered fossil traces of shapes virtually identical to the simplest bacteria still living today. These tiny microbes, only a few thousandths of a millimetre across, consisted of a single cell without a nucleus. They thrived in the mineral-rich environment of early Earth's oceans, multiplying by splitting again and again.

Very early, microbes developed the ability to manufacture their own food from carbon dioxide and water—and in so doing changed the very environments in which they evolved. Oxygen produced by photosynthetic microbes, and later by plants, currently accounts for 20 per cent of the air we breathe

It is likely that the so-called extremophile microbes, those that thrive today under conditions that we would consider uninhabitable, are remnants of the earliest forms of life. Though microbes of various types can be found literally everywhere on Earth today, the conditions once favourable globally for the proliferation of these earliest anaerobic forms can now be found only beyond the reach of an environment permeated by oxygen, which is hostile to their existence. These relics today take refuge in places such as salt flats, sulphur pools, deep-sea vents, and even your intestines.

Very early, microbes developed the ability to manufacture their own food from carbon dioxide and water by chemosynthesis, a process powered by chemical reactions, or photosynthesis, in turn powered by light energy, and in so doing, changed the very environments in which they evolved. Chief among their early waste products was oxygen, a deadly poison to themselves as anaerobic organisms. Fortunately for them, the early seas were full of dissolved iron. The waste oxygen produced by microbes reacted with the iron to form iron oxides—rust—that settled onto the sea floor, taking the oxygen out of circulation as quickly as it was produced. Most of the largest iron deposits, mined today in many parts of the world, were formed during these early days of oxygen production—between about 2.7 billion and 2 billion years ago.

Once the dissolved iron in the seas was depleted, free oxygen began to accumulate both in the water and in the air above. Microbes had created an environmental crisis for themselves: they had to find a way to isolate themselves from this deadly gas or adapt to tolerate it. Eventually microbes evolved that not only tolerated oxygen but actually used it in their metabolism. Oxygen produced by photosynthetic mi-

crobes, and later by plants, currently accounts for about 20 per cent of the air we breathe. Ozone, a particular form of oxygen molecule, forms a layer in the high atmosphere that absorbs much of the ultraviolet radiation from the sun before it reaches Earth's surface. If all life were to stop, the free oxygen in our atmosphere would quickly be expended in chemical reactions and would not be replenished.

These early life forms affected their environment in other ways, too. Earth's atmosphere is a cycle of gases that dissolve in the planet's water and then are released into the air to maintain a delicate chemical equilibrium. As gases are released from deep within the Earth by volcanic eruptions, they join the cycle. Life disrupts this balance by taking some materials permanently out of circulation.

A significant contributor to this process was a group of microbes called cyanobacteria, which lived together in vast mats of slime on the sea floor. Their presence caused carbonate from dissolved carbon dioxide to react with calcium in the water and settle on the slime, as limestone mud. Bacterial filaments grew up through the mud layers and spread to form a second layer of slime, which in turn was covered by mud—and so on—forming layered structures called stromatolites. In this way, huge thicknesses of carbonate sediment accumulated, hardened, and turned to rock. This process effectively took carbon dioxide out of circulation and helped to reduce the atmosphere from a dense mixture of mostly carbon dioxide to our present-day, relatively thin air.

Huge amounts of carbon, mostly from carbon dioxide, are also removed from the atmosphere by the bodies of living things. Carbon is contained in their soft tissues and in shell, bone, wood, and other resistant tissues. Some is reused in the normal cycle of death, decay, and rebirth, but much has been locked away over the years. Some rocks are composed almost entirely of the fossil shells of ancient sea creatures; fossil fuels are the organic remains of masses of organisms—animals, plants, and microbes—that accumulated before they had a chance to be recycled.

The removal of carbon dioxide from the cycle of gases helped keep the Earth cool. As a greenhouse gas, carbon dioxide traps heat from the sun and holds it in the atmosphere, keeping the surface of the Earth warm. While the early sun was getting hotter, the presence of living things on Earth reduced the greenhouse effect by removing carbon dioxide from the atmosphere. Without life, carbon dioxide released through cracks in Earth's surface and from the weathering of rocks by water, would once more build up and the temperature of the Earth's surface would rise, perhaps enough to boil away the oceans.

While microbes were busy changing their environment, they themselves were evolving to cope with the new condi-

Without life, carbon dioxide released through cracks in Earth's surface and from the weathering of rocks by water would once more build up and the temperature of the Earth's surface would rise, perhaps enough to boil away the oceans

tions. Because the simplest microbes multiply by splitting, successive generations should theoretically be identical to their forebears; but mistakes can and frequently do happen. When new microbe forms created by mistake are able to survive, they pass on the new properties to their descendants. By about 1.9 billion years ago, simple microbes had diversified into an astonishing variety of shapes and, presumably, life styles. Many microbes today live cooperatively, and some early anaerobic bacteria may actually have taken refuge inside the cells of oxygen-tolerant forms. Since they did not interfere with, but actually contributed to, the well-being of their hosts, these microbes eventually became so well accepted that the two organisms became one. In this way, cells with a nucleus formed, making sexual reproduction possible. This new reproduction style, in which properties of two parent cells are combined, allowed for much more rapid change. Cells with a nucleus are also aerobic—they use oxygen—and have much more efficient metabolisms than their anaerobic counterparts. Large numbers of cells could group together and become specialized in different functions. This was the basis from which the first multi-celled organisms appeared—life forms that can be seen without a microscope.

Fossils of probable multi-celled algae, or early seaweed, are preserved in rocks 750 million years old and possibly older. The first known animals, strange soft-bodied forms, appeared only about 565 million years ago. Their fossils are widespread, having been found as impressions in rocks in Newfoundland, northern Canada, England, Australia, and Siberia. By about 543 million years ago, animals developed the ability to form shells for protection, and suddenly, almost overnight in geological terms, animals diversified into

numerous forms. Virtually all the major groups of animals alive today had their beginnings in this early biodiversity explosion. The fossils of the Burgess Shale in British Columbia show us a tantalizing glimpse of this early diversity (see "Dinocarids," page 24). By about 410 million years ago, animals and plants moved out of the sea and onto land. A whole new world was there to exploit, and life quickly spread and evolved to fill the newly annexed space.

Although the story of life is long, covering more than 3.8 billion years, for the first 3 billion years the players were microscopic and elusive. Huge stromatolites are the result of tiny microbes at work, but we have only the sketchiest evidence of the character of these organisms. The reason for this is twofold: single-celled organisms usually disappeared without a trace after they died; and the rocks containing their rarely preserved remains are so old that they themselves have been altered by the heat and pressure of burial, destroying whatever fossils they might have contained. Once organisms developed hard parts—shell, bone, and woody tissue—they began to leave an abundant record of their existence in the form of fossils.

As living things evolved, huge geological forces were also at work on Earth. The relentless cycle of plate tectonics has slowly rearranged the planet's crust, building continents, moving them about, and constantly changing the face of the Earth. Erosion of rocks by wind and rain has added chemicals and sediment to the seas, resulting in a thick blanket of sedimentary rock over much of the planet's surface. Occasional vast volcanic eruptions have added huge amounts of dust and poisonous gases to the atmosphere. Even extraterrestrial forces have had an effect on Earth and its life forms in that huge meteoroid impacts are implicated in more than one major extinction of living things.

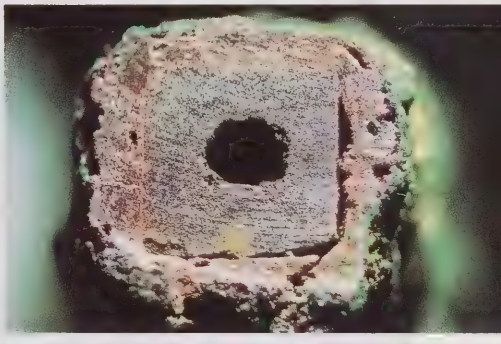
Change has been the one constant in Earth's history and life has taken on many forms. The story of life on Earth is like the archived chronicle of a long-running play. Major and minor actors come and go; occasionally almost the entire cast quits but is quickly replaced. Over time, there are subtle changes in interpretation; the sets are repainted; the costumes updated; sometimes the whole theatre gets renovated. But the underlying story remains the same. Life created the conditions in which it thrives today, and maintains those conditions of atmosphere and temperature within very narrow parameters. Mass extinctions have occurred many times in the past, likely from many different causes, but life has always recovered. Although it may be true that we are currently facing the world's greatest-ever extinction process, we can be fairly confident that, whatever happens, life in some form will carry on. And, as long as there is life, Earth will remain the alien planet.

Buried Treasures

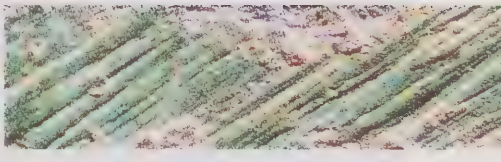
The Case for Mechanical Cleaning

BRIAN BOYLE, ROM

SUSAN STOCK, ROM



KATHY DAVID, ROM



KATHY DAVID, ROM

Top: These Bronze-Age points, adzes, and daggers were uncovered beneath huge stones in Yemen. Middle right: The massive corrosion surrounding the point, seen in this cross section, was removed mechanically. Bottom right: Working marks made by a craftsperson 3000 to 4000 years ago were revealed. Bottom left: Chemical cleaning left corrosion over the figure's face on this Etruscan mirror.

MANY A Museum visitor admires displays of ancient artifacts without ever realizing the amount of work that goes on behind the scenes to ready these objects for public view. Pieces that have undergone painstaking cleaning and other restorative processes may appear simply to have been removed from the ground, dusted, and put into a case. How far from the truth! Because most materials are subject to deterioration while buried, the majority of archaeological artifacts require careful conservation before they reach the galleries.

The task of a conservator begins with a detailed visual study and scientific analysis of the artifact to identify its features, composition, and decorative details, and to determine its condition. The conservator can then decide upon a suitable treatment. This may involve cleaning, stabilization to prevent further deterioration, and repair of breaks and damage, which often adds support to weakened materials. Purely cosmetic work may also be required to render the piece more "readable," approximating its original appearance.

This detailed work gives the conservator a unique understanding of the importance of what may lie buried within an artifact's layers of corrosion. The details uncovered through conservation can contribute considerably to an understanding of how, when, or why an artifact was created—and even something of the people who produced it. To recover maximum information from ancient finds, I advocate careful, mechanical cleaning, which may reveal

SUSAN STOCK

features that would be lost or obscured by alternative cleaning techniques.

At the beginning of the 20th century, conservation as a science was in its infancy. Experimentation to find effective metal-cleaning techniques focused on "wet" treatments to remove surface corrosion. These were electrolytic or electrochemical in nature. Later, when research revealed chlorides (Cl-ion), found in ordinary table salt (NaCl), to be the key factor in corrosion on copper alloy and iron artifacts, it was hoped that wet cleaning would also, by removing the chlorides, arrest corrosion. These treatments were lengthy, messy, and not 100 per cent effective. Over the years other chemical cleaning agents were added to the wet treatment cookbook.

These work well when the corrosion layer is thin and uniform and the object beneath is sound. Unfortunately, objects that are heavily corroded or deeply pitted are left with an uneven appearance resembling Swiss cheese, as much of the original metal, having lapsed into corrosion, is dissolved away during cleaning. Without a complete inspection before treatment, inlays, gold leaf, and other surface decoration might also be lost without anyone ever knowing of their existence.

The main difficulty with wet treatments is that they cannot selectively remove corrosion. On metal objects that have spent time underground, the patina is often a pseudomorph, or twin, of the artifact's original surface. After many years of burial, the surface may no longer exist as metal, but be replicated in a layer of corrosion. With wet treatments, the corrosion is indiscriminately removed—the more soluble the corrosion product, the more quickly and efficiently—consuming the patina and, with it, the fine details that lie within.

A point and other artifacts recovered during Dr. Ed Keall's excavation work at al-Midamman, Yemen, in 1997 (see *Rotunda*, Fall/Winter 1997) nicely illustrate the advantages of mechanical cleaning. Often, small finds such as these daggers, points, and adzes may be considered unremarkable, and the archaeologist might request a quick clean. Luckily, these objects were considered exceptional because of the location from which they were excavated: under a monolithic stone column, the handiwork of a previously unknown Bronze-age civilization. When Dr. Keall brought these objects to Canada for conservation, we realized just how rare they were. The Canadian team was the first to examine the artifacts in depth, and the information derived was unique.

Mechanical cleaning of the point and other artifacts proved very difficult. They were virtually mineralized, with almost no actual metal remaining. Their shapes were preserved in and composed of dense layers of thick, hard, corrosion products. Wet cleaning would have left almost nothing recognizable intact. In the photograph of the cross-section (previous page), the point's original shape can be clearly seen as a square beneath a layer of massive corrosion. My intent was to remove the overlying corrosion to reveal the layer that represents the original surface.

The results are visible in the photo (previous page). Minute polishing or working marks, barely visible to the naked eye, can be clearly discerned when magnified 30 times. The presence of these marks indicates that the artifacts were carefully hand-finished. As yet, we have seen no evidence of wear resulting from use. This may indicate that the tools and weapons may have been buried ceremonially. What is remarkable is that the hands that shaped these tools 3000 to 4000 years ago left marks of their human touch that are still visible today. After months of meticulous labour, these findings are well worth our efforts.

Susan Stock, the ROM's archaeological metals conservator, trained at the Institute of Archaeology, London, and enjoys sharing her years of experience.

Dear ROM Answers,

This bowl has been in my family for at least 50 years. Its glass is pale amber and contains many tiny bubbles. The figures are rust-coloured and outlined in black, and a black Greek key pattern surrounds the lower section. In the centre of the bottom lies a small indentation. There are no markings. Any information that you could provide on the history of my bowl would be appreciated.

J. B., Toronto

Top and above left: This glass bowl, 9 cm (3 1/2 inches) high and 24.8 cm (9 3/4 inches) in diameter at the rim is decorated in the Egyptian Revival style. Above: The earthenware dessert dish from the ROM's European ceramics collection was produced around 1800 in the same style by the Giustiniani Factory of Naples. Left: Royal Doulton too produced items in this style such as this plate, made around 1908 – 1916, which sports fake hieroglyphics.

PHOTOGRAPHS BY BRIAN BOYLE, ROM

Dear Reader,

Judging from your photographs, this bowl (at right and above) was probably made during the 1920s. The shape and type of glass are typical of the period, and motifs derived from ancient Egyptian wall paintings or carved stone reliefs, such as the charioteers depicted on your bowl, were popular at that time. The discovery of King Tutankhamun's tomb by British archaeologist Howard Carter in 1923 fuelled public fascination with ancient Egypt, and the wealth of royal artifacts from the tomb inspired the popular use of Egyptian motifs, mainly in Europe and Britain, in jewellery, costume, some furnishings, and other decorative arts, such as ceramics. A wooden daybed made in the 1920s and donated to the ROM in 1989 by Bernard and Sylvia Ostry, for example, is copied from one found in King Tut's tomb.

Glass decorated in the Egyptian Revival style, however, is comparatively uncommon, and is seen primarily in perfume bottles and other cosmetic articles. When I examined your bowl (which was brought to the ROM to be photographed), I was struck by the colouring of the charioteer figures. Each one is exactly alike, which suggests they were printed first in enamel colours and later affixed permanently to the glass by firing it in a low-temperature kiln. This, and the painted black rim and Greek Key pattern, combined with the carefully polished pontil mark on the bottom where the iron rod or pontil would have been attached to handle the glass when hot, all suggest that your bowl was produced by a highly skilled glass factory. It was most likely manufactured in Bohemia, Czechoslovakia (now the Czech Republic), from where considerable quantities of well-made household glass, often with enamelled decoration, were imported into

PETER KAELLGREN

Canada in the 1920s, usually retailing at reasonable prices. Germany and Poland are other possible sources for your bowl, although most of the pieces I have seen are Czech, with the words "Czechoslovakia" or "Made in Czechoslovakia" fairly regularly etched on the bottoms.

Likely made to hold fruit or flowers, your bowl may have been part of a console set, consisting of a bowl and a pair of candlesticks, or in very elaborate circumstances, two pairs. These were often low in stature as the set was intended to sit in the centre of a dining room table, on a sideboard, or perhaps on another piece of furniture. Regarded as ideal gifts, console sets, mostly of ceramic or glass, were popular from about 1910 until the early 1940s. My mother received a set done in American pottery during the 1940s, which I still have.

Egyptian Revival has been in vogue from time to time since around 1800, when the style was first inspired by Napoleon's Egyptian campaign and Britain's efforts to hold his power in check. The ROM's European collections house an intriguing range of such pieces. Perhaps the most entertaining is a white earthenware plate produced at the Royal Doulton Pottery of Burslem, England, sometime around 1908–1916 (photo previous page). The plate is labelled "Egyptian Pottery" and "Egypt/Personally Conducted Tours." Considerable artistic license was taken in creating the fake hieroglyphics at the top, which indicate a London "bobby," dumbbells, and a cane.

Another such piece, on display in the ceramics section of the Samuel European Galleries, is a serving dish from an earthenware dessert service (photo previous page) produced by the Giustiniani Factory of Naples, Italy, around 1800. The kings of Naples took a strong interest in archaeology because of the discovery nearby of the two first-century Roman towns Pompeii and Herculaneum, which had been buried by a volcanic eruption of Mount Vesuvius

Collecting at the Gardiner Museum

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Rococo to Revolution

18th-century European porcelain from the Hans Syz Collection.

May 26 – August 29, 1999

Toronto Collects
Contemporary Ceramics

An exhibition of ceramics from private collections in the Toronto area.

May 26 – August 1, 1999

Exhibition Programs

Please call (416) 586-8080 for more information

Tuesday, June 1, 6:30-7:30 p.m.
Hans Syz, Collector and Philanthropist with curator Sheila K. Tabakoff
$10 Members, seniors, and students;
$13 general public. (P234)

Tour, Talk and Have Tea with Contemporary Collectors

Wednesday, June 9, 2-4 p.m. Aaron Milrad
$15 Members, seniors and students;
$18 general public. (P235)

Thursday, July 15, 2-4 p.m. Margaret Taylor
$15 Members, seniors and students;
$18 general public. (P236)

Tuesday, June 22, 12:30-2 p.m.
The A to Z of Collecting with curator Sheila K. Tabakoff
$25 Members, seniors and students; $30 general public.
Includes a catered lunch by à la Carte. (P237)

Sunday, June 27, 1-4 p.m.
Calling Collect! Collectors of objects of all shapes and sizes are invited to display their collections at the Museum.
Please call (416) 586-8080 to reserve a display table.
Free with admission.

Museum Hours
Tuesday 10 a.m - 8 p.m.,
Wednesday - Saturday 10 a.m. - 5 p.m.,
Sunday 11 a.m. - 5 p.m.
Closed Monday

Admission
FREE EVERY TUESDAY
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Free year round for Gardiner Members

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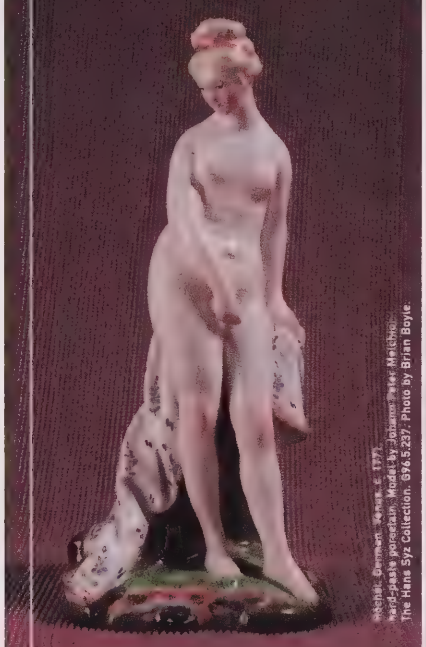
Rococo to Revolution

The Hans Syz Collection



Michel Carlin, Germany, active c. 1771.
Hard-paste porcelain. Model by Johann Peter Melchior.
The Hans Syz Collection. 696.5.237. Photo by Brian Boyle.

Toronto Collects

Contemporary Ceramics

Garry Williams, The Legacy Cup, 1985.
Earthenware and glazes. Collection of Ann Mortimer.
Photo by Brian Boyle.

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in AD 79. The black and terra-cotta red on the Giustiniani dish are much like the colours on your glass bowl. These hues were commonly used in ancient Greek "red figure" and "black figure" vases, which had been found in abundance in the ancient tombs of Italy. To some designers, they seemed just right for dramatizing the Egyptian Revival style and were frequently used for that purpose.

An early example of Egyptian Revival is a pair of candlesticks with figures of patinated bronze that suggest ancient Egyptian women. These ROM pieces are likely to be French and date somewhere around 1820. The gilded bronze candle cups and drip pans hint at Egyptian plant motifs; however, reliefs on their bases bear classical Roman details such as crossed torches, quivers of arrows, and doves. The candlesticks were bequeathed to the ROM by Mr. W. J. Thorold in 1942.

Ancient Egypt has long fascinated Western civilization. Next year, the ROM will host an important exhibition *Egyptian Art in the Age of the Pyramids* organized by the ROM, the Réunion des Musées Nationaux (the Louvre Museum, Paris), and the Metropolitan Museum of Art (New York). The Department of Western Art and Culture would like to add to the exhibition with a small show of pieces in the Egyptian Revival style from the ROM's collections. The Giustiniani dish, the King Tut replica day bed, and a chair from the 1880s (also donated by Bernard and Sylvia Ostry) were all borrowed by the National Gallery of Canada for the 1994 exhibition *Egyptomania: Egypt in Western Art, 1730–1930*. It's amazing how many wonderful Museum pieces complement special occasions like this. Thank you for writing to ROM Answers.

Peter Kaellgren is curator in the ROM's Department of Western Art and Culture, specializing in British and European decorative arts from 1500 onwards. Peter's column "ROM Answers" originally appeared in City and Country Home *from 1982 to 1992.*

If you own furniture, silver, glass, metalwork, ceramics, textiles, or small decorative objects that may have an interesting past and have aroused your curiosity, this column is for you. Send a clear colour photograph (or 35-mm colour slide) of the object against a simple background, providing dimensions, a description, any markings, or any known details of its history to: ROM Answers, c/o *Rotunda* Magazine, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6. Be sure to enclose a stamped, self-addressed envelope large enough to include any photos that must be returned to you.

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Ashbridge's Bay: An Anthology of Writings by Those Who Knew and Loved It

Edited by George Fairfield
(Toronto Ornithological Club, Paper: $19.95)

Charles Trick Currelly, the first director of the Royal Ontario Museum, once recalled in a biographical memoir that Toronto Island was historically an overwintering ground for snowy owls. Reading the present work, one is indeed reminded of the former shorebird-sanctuary nature of Toronto's waterfront. Once one of the great freshwater marshes of eastern North America, and later a victim of land reclamation, Ashbridge's Bay is recalled lovingly here by many who knew it. Only a small portion of the original bay remains.

The idyllic recollections of the contributors, including Elizabeth Simcoe and Wellington Ashbridge, for whom the bay was named, evoke a pastoral haven, a haunt of fish and wildfowl, a habitat of diverse wetland flora. *Ashbridge's Bay* explores the area's natural history as well as its economic and recreational life. (A member of my family, born in 1911, recalls skating parties on the bay when she was a child. The ROM's Canadiana collections include watercolours of iceboating there in the 19th century). The book concludes optimistically with a look at efforts towards restoration.

Celebrating Homer's Landscapes: Troy and Ithaca Revisited

By J. V. Luce
(Yale University Press, Cloth: $52.50)

Emeritus professor of classics at Trinity College, Dublin, Luce is also a lecturer and tour guide on Swan Hellenic cruises, tracing the wanderings of epic navigator Odysseus over the Aegean, the bardic "wine-dark sea." Citing the vivid renderings of place in the *Iliad* and the *Odyssey*, Luce compares them with the newest archaeological evidence to demonstrate that, far from poetic licence, Homer's depictions appear to be true to the original.

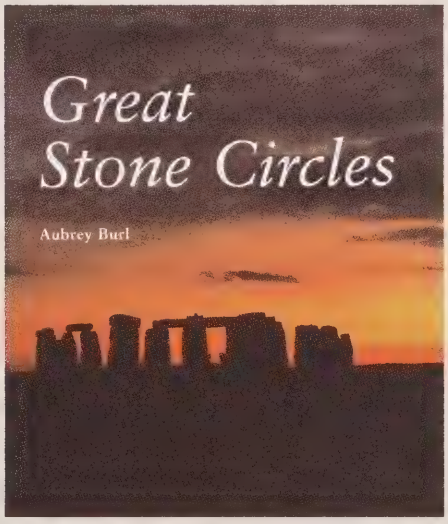
Luce's perspectives as scholar and tour guide merge admirably. The full-colour photography evokes the cruise, as the reader glides past Homeric landmarks—the Hellespont, Poseidon's Watchtower, the Raven's Crag. Aerial photography recreates the "god's eye view," as described by Homer, the sightlines from power base Olympus and other airy heights.

Ancient Land, Ancient Sky: Following Canada's Native Canoe Routes

By Peter McFarlane and Wayne Haimila
(Alfred A. Knopf Canada, Cloth: $33.95)

An ancient Canadian legend, *La Chasse-Galerie*, recounts the celestial

FEATURE REVIEW



Great Stone Circles

By Aubrey Burl
(Yale University Press, Cloth: $44.95)

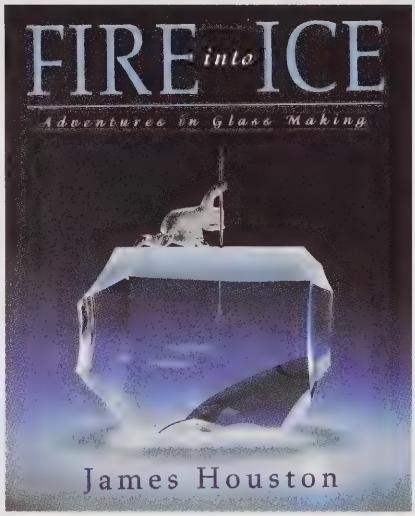
Archaeologist Burl, an expert on prehistoric stone circles, illuminates 12 evocative British examples—from the iconic Stonehenge, in Wiltshire, to Oxfordshire's Rollright Stones, Somerset's Stanton Drew, and Cumbria's Long Meg and Her Daughters. Circles of mystery and power, the stones are examined for purpose, construction, age, distribution, design, art, relation to astronomy, and legend. And the legends are numerous: a wedding party turned to stone for dancing on the Sabbath; a Scandinavian king metamorphosed by a witch, but who with his warriors would one day rise and rule the land; and village maidens dancing in stone circles at midnight on midsummer's eve to be given a glimpse of their future husbands. Well illustrated with colour photographs, figures, and archival art.

COMPILED AND REVIEWED BY GLEN ELLIS

flight of a group of voyageurs whose aeronautic watercraft, "the flying canoe," carries them through the night sky. (I first encountered this bit of CanLore on an NFB filmstrip when I was ten. The canoe surged through scudding moonlit clouds). In *Ancient Land, Ancient Sky*, 20th-century voyageurs McFarlane and Haimila use a single-engine Cessna 172—their own version of *le canot volant*—to follow the original canoe routes into the interior. What emerges is a saga of discovery, a reconnecting to the land, its vastness, its people, and its history. McFarlane, of Irish descent, is a Montreal-based pilot and writer. Haimila is a lawyer, journalist, and political advisor whose ancestors were Tsimshian, Métis, and Cree.

Fire into Ice: Adventures in Glass Making

By James Houston
(Tundra Books, Cloth: $18.99)



THIS SPECTACULAR ADDITION to McClelland & Stewart's Young Readers series chronicles Houston's own introduction to the art of glass. Arctic adventurer, artist, entrepreneur, cultural liaison, and ambassador, James Houston has led many lives. *Fire into Ice* is a gallery of glass sculptures he designed for New York's Steuben Glass. And what a gallery it is. The sculptures are liquid sunlight or moonlight—solidified, glittering arctic jewels, gemstones of the aurora borealis. Some of my personal favourites are *Excalibur, Trout and Fly, Dancing Cranes, and Blue Whale.* The photography, courtesy Steuben, is exquisite. Its symbiosis with Houston's book design makes *Fire into Ice* an *objet d'art* in its own right.

From Old English to Standard English

By Dennis Freeborn
(University of Ottawa Press, Paper: $35)

In *The Mother Tongue: English and How It Got That Way*, language connoisseur Bill Bryson notes that more than 300 million people in the world speak English and that "the rest, it sometimes seems, try to." Of special interest to aficionados of English, this second edition of a linguistic landmark draws on more than a hundred facsimile texts to demonstrate language variation over time, from the *Book of Kells* to hypertext. Of appeal also to students of typography.

Glen Ellis is head of Publications, Royal Ontario Museum

THE VIRTUAL WORD

Video Display Terminals have given new meaning to the idea of illuminated manuscripts. On-screen text is virtually—although perhaps not verily—more light-based than a mediaeval psalter.

Electronic media has also expanded the publishing vernacular. A book designer advised me recently that a photo image had "bit-mapped out." And I confess there are times when I feel like JAVA man.

But whether expressed on stone, hide, papyrus, or parchment—or through electrons and glass—the impulse to publish is human and constant. The Virtual Word is a corner for the published electronic word and image, the companion "volume" to LIBRIS.

Franklin's First Expedition to the Shores of the Polar Sea

Arctic Discovery Volume I. CD-ROM. (University of Toronto Press, $69.95)

THE ALLURING and seemingly vaporous Northwest Passage once exerted a siren-like influence over many mariners, drawing them into winterscapes beyond their worst imaginings. Sir John Franklin's second expedition (1825–1827) met with even more success than the first (1819–1822). The third put a stop to all of it and subsequently cost Mrs. Franklin a fortune in her vain efforts to find her northern Ulysses.

The Franklin team's eyewitness accounts have been digitized here at both low resolution for quick access and at high for superior printing. Material is stored in Adobe PDF format. File readers for Win95 and MacOs are included. G.E.

SUMMER MEMORIES

. . . when the living was easy

ROM ARCHIVES, PHOTOGRAPHER UNKNOWN

The wrought-iron fence is still there, separating the Museum's terrace lawn from Bloor Street, but the vintage automobiles, the fashion, and the elegant brick building, just visible through a veil of leaves, are clearly of an earlier time.

The date was August 25, 1945, the last day of Summer Club for the year. It had been the first summer of the '40s unclouded by war, and in Toronto spirits were high. But the pure glee of the barefoot runners is timeless.

A ROM tradition, Summer Club began in 1938. Childhood summers are recalled with nostalgia by its many alumni. Attendance in 1946 was 114 (compared with more than 850 last year). Total expenses amounted to an enviable $419.

JULIA MATTHEWS

Julia Matthews, head of the ROM's Library and Archives since 1983, led the team responsible for launching the Museum's Web site. Her special interests are museology and the history of the ROM.

If you have memories of the ROM you'd like to share, please send them to Julia Matthews at Library & Archives or e-mail them to info@rom.on.ca. Your recollections will be posted on the ROM's Web site.

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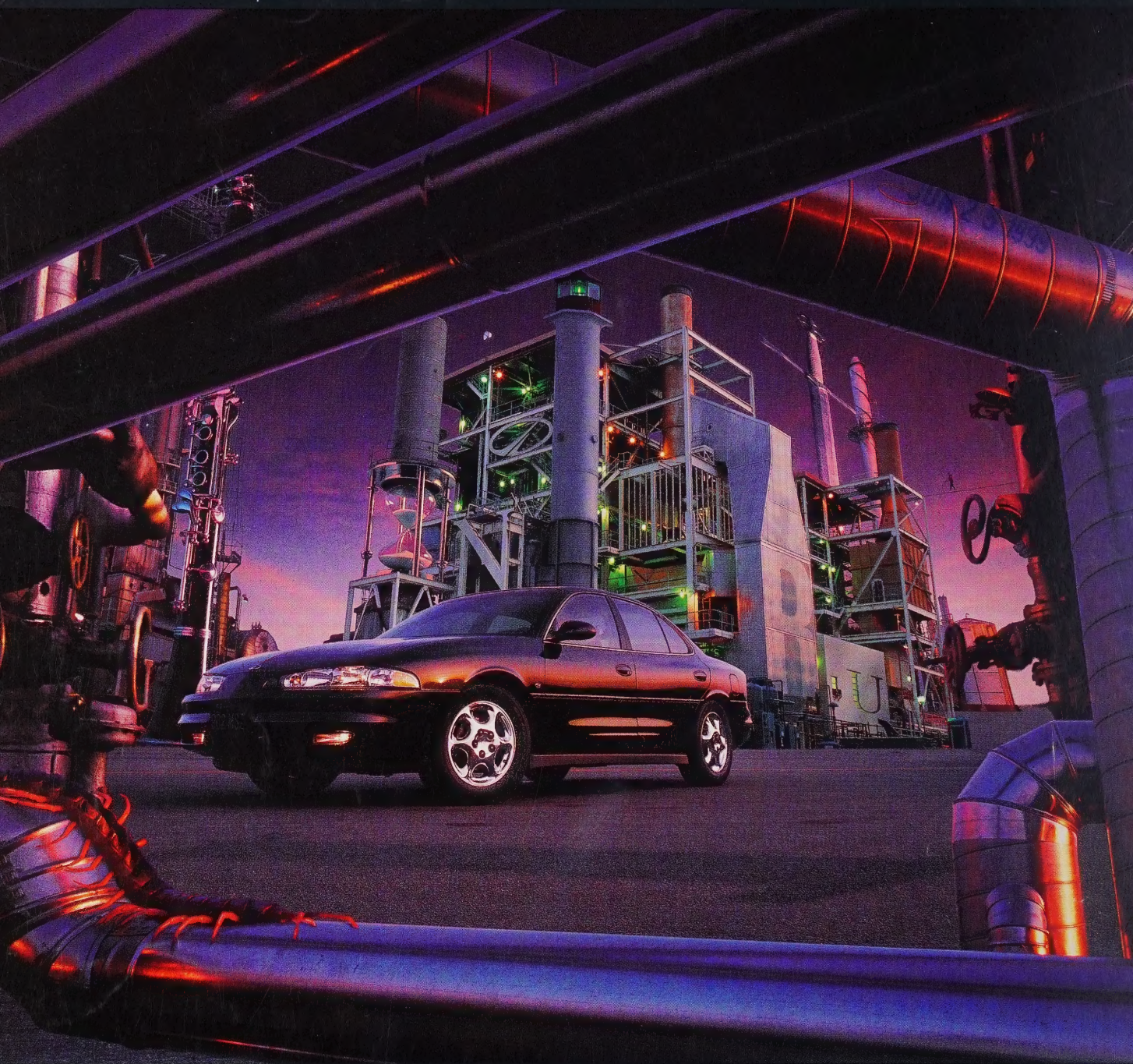

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